Multi*Modem*^{II}

**BA-Series
Intelligent Data/Fax Modem**

User Guide

MultiTech®
Systems

User Guide

88312001 Revision B

MultiModem^{II} Models:
MT2834BA/MT2834BAI

Record of Revisions

A	(06/01/99)	Manual revised. Manual reformatted for electronic distribution. All pages remain at Revision A.
B	(08/15/02)	Replace Trio with PhoneTools; change phone numbers; add patents; revised safety warnings

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Chapter 1 - Introduction and Description

MultiTech Systems

1.1   Introduction

Welcome to the world of data communications. You have acquired one of the finest intelligent desktop data/fax modems available today, the MultiModem^{II} BA series modem, from Multi-Tech Systems. This User Guide covers various models within the BA series, and unless otherwise noted, all content should be considered relevant to all models.

Your MultiModem provides data communication at the following rates:

<div align="center">

33,600 - 14,400 bps (Enhanced V.34 / V.32bis)

</div>

The MultiModem also provides other prevalent data communications standards and includes dial backup with automatic lease line restoration, adaptive protocol enhancing used in typical Unix® batch file transfers and support for IBM's AS/400™ and Windows™ environments.

1.2   How To Use This Manual

The information contained in each chapter and appendix is as follows:

Chapter 1 - Introduction and Description

This chapter begins with a short introduction, followed by a guide (which you are now reading) to the use of this manual. There is a discussion about what components you can expect in your modem package. We then provide a more detailed description of the modem, including the modem's technical specifications. Chapter 1 includes sections covering power, LED indicators and a brief summary of PC board controls. (Chapter 9 covers switch settings more thoroughly.)

Chapter 2 - Installation and Connection

Chapter 2 covers the procedure for connecting the modem to your computer and to the phone line. Details are given, supported by illustrations on the modem's back panel connections as a guide to install your modem to the point of operation. In addition, this chapter describes the installation of PhoneTools, the communications software included with your modem.

Chapter 3 - Software Configuration and Modem Basics

Chapter 3 documents communication software configuration recommended specifically for the MultiModem. Other issues covered include setting up initialization strings, changing default parameters, configuring software for the remote system and file transfer protocols.

Chapter 4 - AT Command Mode Operation

Chapter 4 may be the most important chapter of this manual. It begins with an introduction and discussion on Command Mode fundamentals. A flow chart is provided to illustrate Command Mode and On-Line Mode operation and the methods used in each mode. Next, there is a summary of the modem's commands and responses. We then go into a detailed explanation of each modem command, providing examples where applicable.

Chapter 5 - S-Registers

Chapter 5 covers the modem's S-Registers, which enable the user to establish, read, and modify various modem options. All of the S-Registers are charted and explained, followed by instructions on accessing the S-Registers and reading or changing their values.

Chapter 6 - Callback and Remote Configuration

Chapter 6 documents instructions on how to operate the modem's Callback and Remote Configuration features; and the usage of LOGIN Passwords, Set-Up Passwords and Remote Escape Characters as network management tools.

Chapter 7 - DIP-Switches

Chapter 7 covers the modem's printed-circuit board options. Sixteen DIP-Switch settings and the modem's speaker volume control are explained in detail, including all default settings.

Chapter 8- Warranty, Service & Technical Support

Chapter 8 provides statements on your five-year warranty, instructions for getting modems serviced at the factory and the procedure for downloading firmware upgrades via FlashROM.

Appendixes

There are also several appendices at the end of this manual, most of which repeat information contained in the chapters, but in a more condensed form. These appendices can be used as a quick reference.

Appendix A - Upgrading Your Modem's Firmware
Appendix B - Troubleshooting
Appendix C - AT Command Summary
Appendix D - V.25bis Operation
Appendix E - Cabling Diagrams
Appendix F - Regulatory Information

1.3   Modem Features

The MultiModem BA Series modem connections can be made on Public Switched Telephone Networks (*PSTNs*) and/or point-to-point 2-wire telephone type circuits.

Your modem offers interactive automatic dialing, as well as Command Mode option configuration. You may store up to ten command line/telephone numbers, of up to 60 characters each, in the modem's nonvolatile memory. The modem pulse or tone dials, and recognizes dial tones and busy signals for reliable call-progress detection. The modem can detect AT&T calling card tones. It is FCC-Registered for connection to telephone networks without any Data Access Arrangements (DAA's).

Your modem also features Callback Security to protect networks from unauthorized use, and to manage phone line costs. By using the modem's phone number and password directory, a host site can, upon receipt of a call, callback to a remote site at a predetermined number.

Remote Configuration permits you to assist users at remote sites, saving you the time and trouble of site visits and preventing misinterpretation of configuration instructions.

1.3.1   2834 Series Features

Your MT2834BA modem meets the proposed *Enhanced V.34* ITU standard for data signalling rates as high as 33.6/31.2K bps in full duplex mode. *Enhanced* V.34 is an extension of V.32/V.32bis/V34 standards, and supports and is compatible with those features, including EIA extended Automode; adaptive line probing; automatic symbol rate and carrier frequency during start-up; and retrain and rate renegotiation (in 2400 bps increments).

The MT2834BA features ITU V.25bis standard for synchronous dialing, ITU V.42 error correction and V.42bis data compression, providing 100% error-free data transmission. V.42 error correction incorporates MNP(Classes 3 and 4, and LAP-M. You may select V.42bis data compression for 4-1 throughput, or MNP Class 5 for 2-1 throughput.)

1.4   Fax Features

Your modem meets the ITU V.17 standard for sending and receiving faxes. When linked to a compatible fax machine or modem, it can transmit faxes at 14,4 K bps. It also meets the ITU's Group 3 Designation for sending and receiving faxes at 9600 bps; and Group 2 Designation for sending and receiving faxes at 4800 bps. The modem is also downward-compatible with modems to speeds as low as 300 bps, so it can send and receive faxes with any fax machine in the world.

1.5 Technical Specifications

Your data/fax modem meets the specifications listed below:

Tradename	MultiModem$^{II™}$
Model Numbers	MT2834BA, MT2834BAI
Data Rates (modem)	33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000, 9600, 7200, 4800, 2400, 1200, 0-300 bps
Data Rates (fax)	14,400, 9600, 7200, 4800 bps
Data Format	Serial, binary, asynchronous at 0-300, 1200, 2400, 4800, 7200, 9600, 12,000, 14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, 33,600 bps; synchronous at 1200, 2400, 4800, 7200, 9600, 12,000, 14,400, 16,800, 19,200, 21,600, 24,000, 26,400, 28,800, 31,200, 33,600 bps
Compatibility	ITU V.42*bis*, V.42, Pending ITU Enhanced V.34 approval, ITU V.34, AT&T V.32*terbo*, ITU V.32*bis*, V.32, V.21*, V.22*bis*, V.22, V.23*,V.25*bis*, *Bell 212A and 103/113, ITU V.17, Group 3 T.4, T.30 and EIA TR-29 Class 2 (*Bell 212A and 103/113 domestic models only; *V.21/V.23 Int'l models only)
Error Correction	V.42 (LAP-M or MNP 3 & 4) error correction
Data Compression	V.42*bis*, (4:1 throughput) or MNP 5 (2:1 throughput) data compression
Speed Conversion	Serial port data rates adjustable to 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600 and 115,200 bps
Flow Control Options	Xon/Xoff, Hardware RTS/CTS, ENQ/ACK, Unix-to-Unix Copy Protocol (UUCP) "Spoofing"
Mode of Operation	Full duplex over both dial-up lines and 2-wire leased lines; automatic or manual dialing, automatic or manual answer
Intelligent Features	Fully "AT command" compatible, microprocessor controlled remote configuration, EIA extended Automode, adaptive line probing, automatic symbol rate and carrier frequency during start-up, retrain and rate renegotiation, autodial, redial, repeat dial, dial linking, pulse or tone dial, dial tone detection, dial pauses, call status display, auto-parity and data rate selection, keyboard-controlled modem options, nonvolatile memory and on-screen displays for modem option parameters and up to ten telephone numbers/command lines of up to 60 digits each, help menus
Command Buffer	60 characters
Modulation	Trellis Coded Modulation (TCM) at 33,600, 31,200, 28,800, 26,400, 24,000, 21,600, 19,200, 16,800, 14,400, 12,000 and 9600 bps, Quadrature Amplitude Modulation (QAM) at 9600 (non-trellis), 4800 and 2400 bps, PSK at 1200 bps, FSK at 300 bps

Fax Modulations	V.21CH2 FSK at 300 bps, V.27ter DPSK at 4800 and 2400 bps, V.29 QAM at 9600 and 7200 bps, V.17 TCM at 14400, 12000, 9600, and 7200 bps
Transmit Level	-11dBm (dial-up), -9 or -15 dBm (leased-line); dBm level selectable with DIP-Switch #3 in leased line setting
Frequency Stability	±0.01%
Connectors	One DB-25 RS-232C connector; two RJ11 for phone line/telephone set; power.
Diagnostics	Power-on Self Test, Local Analog Loop, Local Digital Loop, Remote Digital Loop, Back-to-Back Test.
Indicators	LEDs for Transmit Data, Receive Data, Carrier Detect, Speed Indicators, Off Hook, Terminal Ready, Error Correction, Fax, and Error
Controls	Toggle switches for Voice/Data with Originate or Answer, Power On/Off; and DIP Switches for various modem options.
Speaker	Speaker for call progress monitoring
Operating Temperature	0° to 50° C (32° to 120° F)
Power Requirements	115 Volts AC, 60Hz, 0.3amp (2-prong outlet-mounted transformer) 240V/50Hz optional (International).
Dimensions	6.150" x 9.00" x 1.375" 15.6 cm x 22.9 cm x 3.5 cm
Weight	1.6 pounds/0.72 Kg (without transformer) 2.6 pounds/1.18Kg (with transformer)
Limited Warranty	Five Years

1.6   Power

Power is supplied through an AC power transformer terminated with a standard two-prong plug. The transformer supplies low voltage AC to the modem, and plugs into any conventional 115 volt AC, 60 Hz, two-prong power outlet (240 volts AC, 50Hz, .3 Amp for International modems). The power transformer supplied with the modem is the only one that should be used. Use of any other transformer could cause damage to the modem. A Power On/Off switch is located on the back of the modem.

1.7   Modem LED Indicators

The MultiModem diagnostic LED indicators are shown in Figures 1-1
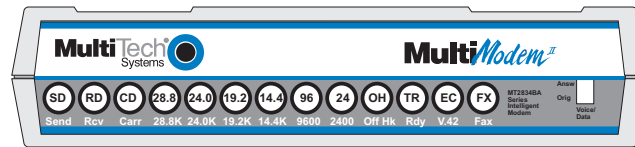
Figure 1-1. MT2834 LED Display

(SD) *Send (Transmit) Data.* This LED blinks when data is being transmitted, on for a space, off for a mark. The state of this LED matches the TD circuit on Pin 2 of the RS-232C/V.24 interface.

(RD) *Receive Data.* This LED blinks when data is being received, on for a space, off for a mark. The state of this LED matches that of the RD circuit on Pin 3 of the RS-232C/V.24 interface.

(CD) *Carrier Detect.* This LED is lit when a valid carrier tone has been detected.

When the modem is connected at 33,600 bps, the 28.8 LED rapidly blinks at approximately 5 blinks per second.

When the modem is connected at 31,200 bps, the 28.8 LED blinks slowly at approximately 1 blink per second.

(28.8) *28,800 bps.* This LED is lit when the modem is connected at 28,800 bps. **Note:** if the modem falls back to 26.4K bps while in V.34 mode, both the 28.8 and 24.0 LEDs light.

(24.0) *24,000 bps.* This LED is lit when the modem is connected at 24,000 bps. Note: if the modem falls back to 21.6K bps while in V.34 mode, both the 24.0 and 19.2 LEDs light.

(19.2) *19,200 bps.* This LED is lit when the modem is connected at 19,200 bps.

(14.4) *14,400 bps.* (2834 and 1432 models only) This LED is lit when the modem is connected at 14,400 bps. Note: if the modem falls back to 12,000 bps while in V.32*bis* mode, both the 14.4 and 96 LEDs light.

(96) *9600 bps.* This LED is lit when the modem is connected at 9600 bps.

(24) *2400 bps.* This LED is lit when the modem is connected at 2400 bps.

(OH) *Off Hook*. This LED is lit when the phone line is *"off hook"*. This occurs when the modem is dialing, on-line, or answering a call. This LED also flashes when the modem is pulse dialing in Command mode.

(TR) *Terminal Ready*. When the TR LED is lit, the modem is permitted to answer an incoming call. When it goes off, a connected modem will disconnect. The state of the TR LED matches that of the DTR circuit on Pin 20 of the RS-232C/V.24 interface.

(EC) *Error Correction.* This LED is lit when the modem is set for V.42 error correction, and flashes on and off when data compression is activated.

(FX) *FAX.* This LED is lit when the modem is connected in FAX mode.

1.8   Controls on PC Board

The MultiModem is designed on a single printed circuit (PC) board. This board contains one 16-position DIP-Switch (numbered 1-16). The DIP-Switches are accessible through a cut-out on the side of the modem. There is also a knob which is used to adjust the speaker volume. This knob is accessible through the modem's rear panel. The sixteen DIP-Switches control various modem options or set default values for Command Mode operation. There is a difference in how several of the switches operate depending on whether you are in synchronous or asynchronous mode. Refer to the switch label on the bottom of the modem for an exact list of the switch functions in asynchronous and synchronous operation.

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Chapter 2 - Installation and Connection

MultiTech Systems

2.1   What is in Your Modem Package?

Your MultiModem is made up of many components. Make sure you have them all before trying to operate your modem.
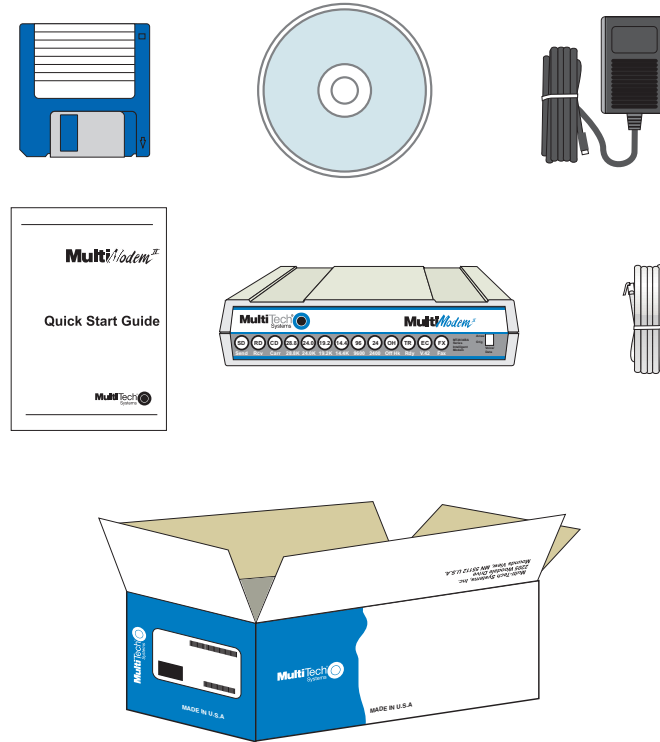
Figure 2-1. Unpacking

Your package should include:

• MT2834BA data/fax modem
• RJ-11 telephone cord
• AC Power Transformer
• One (1) Quick Start Guide
• One (1) software CD (PhoneTools™ data communications and fax software)
• This User Guide (on diskette)

If any of these items are missing, contact Tech Support.

2.2   Installation

The installation of the modem consists of making the physical connections necessary to render the modem functional with your computer. This includes making the proper serial, phone line, and power connections. Unless otherwise noted, these instructions apply to all models of the BA series.

2.2.1 Safety Warnings

1.   Use this product only with UL and cUL listed computers.

2.   To reduce the risk of fire, use only 26 AWG (.41mm) or larger telephone wiring.

3.   Never install telephone wiring during a lightning storm.

4.   Never install a telephone jack in wet locations unless the jack is specifically designed for wet locations.

5.   Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.

6.   Use caution when installing or modifying telephone lines.

7.   Avoid using a telephone during an electrical storm. There is a risk of electrical shock from lightning.

8.   Do not use a telephone in the vicinity of a gas leak.

2.2.2 Installation Procedure

The following procedures will guide you through the physical connections required to make your modem operational. Software loading is covered later in this guide.

Step   Procedure

1   Verify that the settings for DIP-Switch #5 and DIP-Switch #10 match those of your system configuration.

The 16-position DIP-Switch (numbered 1-16) is accessible through a cut-out on the right side (as the LEDs are facing you) of the modem chassis. For a full description of all DIP-Switch Settings, refer to Chapter 7.

DIP-Switch	Condition	Effect
#5	UP*	Selects Answer mode
	DOWN	Selects Originate mode
#10	UP*	Selects Dial-Up operation
	DOWN	Selects Lease Line operation

indicates Factory Default setting

2   Verify that the **ON/OFF** switch at the rear of the modem to the **OFF** (Down) position.

3   Connect the modem to a dial-up line by attaching the RJ-11 telephone cord (provided with your unit) to the **LINE** connector on the modem and to a dial-up wall jack. Refer to Figure 2-2.
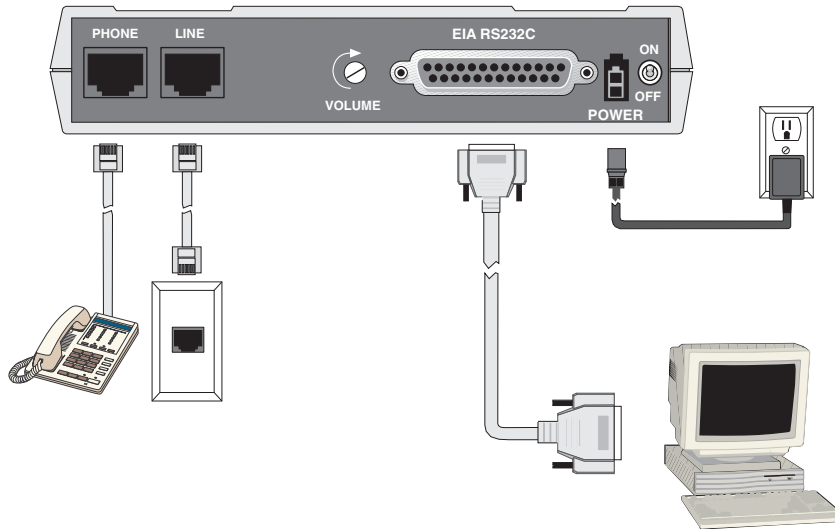
Figure 2-2. MultiModemBA/BAI Connections

4   Attach the **EIA RS-232C** connector on the modem to the serial port on your computer or terminal with an RS-232 (or V.24) cable (you supply). Refer to Figure 2-2.

5   To connect a telephone set to the modem (optional) plug one end of an RJ-11 phone cord into the **PHONE** connector on the modem, and plug the other end into your telephone. Refer to Figure 2-2.

6   Attach the AC Power transformer provided with your unit to the **POWER** connector on the modem and to a live AC outlet. Refer to Figure 2-2.

Note: Only apply power to the modem using the power transformer provided with your unit. Use of a power supply not designed for your unit could result in damage to your modem and will void the warranty.

7   Apply power to the unit by setting the **ON/OFF** switch at the rear of the modem to the **ON** (Up) position. Refer to Figure 2-2.

2.3   Installing Data Communications Software

Data communications software is designed to send and receive messages. Multi-Tech includes a data communications software program, PhoneTools, with your modem. However, the modem will work with any data communications software.

To install PhoneTools, insert the PhoneTools CD in you CD-ROM drive and click the PhoneTools icon. You will be asked to choose your language. The software will then automatically load onto your PC.

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Chapter 3 - Software Configuration and Modem Basics

MultiTech Systems

3.1   Introduction

Chapter 2 described the installation of PhoneTools, a communications software. If you are using a different software package, there are some points you should take into consideration. Since your communications software configuration is affected by the capabilities of your computer, this chapter begins with a discussion of the limitations of some serial ports and how to identify them. It then discusses communications configuration in general and recommends settings specifically for the MultiModem. The last section of this chapter walks you through the basics of using your modem.

3.2   Configuring Your Software

Communications software must be configured to work with your modem, your computer, and the remote system it is calling. Fortunately, most communications programs make the process easy by providing a default *initialization string* for your modem as well as defaults for most of the other required parameters.

3.2.1   Configuring Software for Your Modem

Because remote computers may have different connection requirements such as speed, number of bits, parity, log-on sequences, etc., communications software is typically configured by *sessions*, each session having a unique configuration for a given connection. Most communications programs, however, have a separate modem configuration menu because modem configurations rarely change from session to session.

The most important configuration is the modem *initialization string.* This is a sequence of commands the software uses to configure the modem when the communications software is loaded or when a session begins. Always begin the initialization string with the *AT*tention command **AT**, then follow it with the modem reset command, **&F**. Issuing a reset command before other commands ensures that you are starting with a known state.

The rest of the commands in the initialization string depend on the capabilities of the modem and what you want it to do. Some older communications programs require you to create the initialization string by yourself. Most modern communications programs, however, provide you with a ready-made initialization string that is automatically selected when you choose your modem model from a list. It is a poor idea to use an initialization string intended for another modem, especially one from another manufacturer, because modem capabilities and command implementations vary from modem to modem. However, if your MultiModem does not appear on a modem list, you may use the MultiModemII initialization string.

3.4   PC Initialization Strings

We recommend the following initialization string for a MultiModem connected to a PC-compatible computer when sharing a line with a telephone:

AT &F X4 S0=0 ^M

This string resets the modem to the factory default settings, selects extended result codes with *NO DIAL TONE* and *BUSY,* and turns off auto-answer. **^M** must end every string sent to the modem from software. It is the ASCII code for the RETURN key on most keyboards, and the default code for the carriage return character in the modem and most communications programs. The carriage return character is defined in the modem in S-register **S3**; if you change it, you must also change the carriage return character code used in your communications software. If you send a command directly to the modem in terminal mode rather than indirectly through communications software, you must end the command string by pressing the RETURN key (<CR>) instead of adding **^M** to the string.

The following initialization string is for a MultiModem on a telephone line that functions solely as a *DATA LINE*:

AT &F X4 S0= 2 ^M

3.4.1 Changing Default Parameters

By default, the modem will answer after the first ring and try to communicate with a modem on the other end of the line. If you have one telephone line for voice, fax, and modem communications, the modem may attempt to answer all incoming calls, voice as well as data. To change auto-answer to default off, open your communications program and type the following string in the terminal window:

AT &F S0=0 &F9 &W0 <CR>

This string selects the factory default parameters, then turns auto-answer off and stores that setting, along with all other current parameters, in nonvolatile memory. The **&F9** command causes the modem to load the values from nonvolatile memory the next time it receives the **&F** command. You will use the same initialization string as before:

AT &F X4 ^M

But now the modem will load the values stored in nonvolatile memory when you turn on the modem and when you issue the **ATZ** or **AT&F** reset commands.

Note: Because it clears the command buffer, you should not use **ATZ** in an initialization string.

3.4.2 Other Parameters

The default values for the other parameters in modem configuration menus rarely need changing. They typically include the dialing prefix (**ATDT** for touch-tone service and **ATDP** for rotary service), the dialing suffix (**^M**), the hang-up string (**+++ATH0^M**), and response messages (*RING, NO CARRIER, BUSY,* etc.). Communications software with a host mode might also include an auto-answer string (**AT S0=1^M**).

3.5 Configuring Software for Your Computer

You must configure your communications software to match your computer's configuration. If the modem is connected to the COM2 serial port, you must tell the software you are using COM2. Another important parameter is the serial port baud rate. This is the speed at which your modem communicates with your computer, *not* the speed at which your modem communicates with another modem. When V.42bis data compression is enabled, you must have a serial port baud rate four times the transmission speed of the modem to fully optimize compression. So if your UART is fast enough, you should set the serial port baud rate to a *minimum* of four times the top speed of your modem.

If you have an 8250 UART, your most reliable serial port speed will be 9600 bps; if you have an 8250A or a 16450 UART, try 19,200 bps; if you have a 16550 UART or equivalent, a serial port setting of 115,200 bps can be set reliably.

3.5.1 Configuring Software for the Remote System

You must meet the requirements of the remote system for successful communications. Though the modem can automatically match the speed of the other modem, you must specify parameters such as type of flow control, break length, number of data bits, number of stop bits, and parity. If you set these parameters incorrectly with the remote system, gibberish will appear on your screen.

3.5.2   Terminal Emulation

If you are accessing the remote computer as if from an on-site terminal, the keyboard codes used by your computer may not match the ones used by the remote computer. To be compatible with the remote computer, your software must be able to substitute the appropriate codes in what is known as *terminal emulation*. Most communications programs can emulate the most common mainframe terminals, including the DEC VT100, VT102, and VT52 terminals, and the basic TTY mode. If in doubt about which to choose for a BBS, try ANSI or VT100 first.

3.5.3   File Transfer Protocols

When you upload or download files with your modem, the host computer will ask which file transfer protocol you want to use. Most communications programs allow you to choose a default protocol. Your software's documentation should list the ones it can use (not all communications programs support all protocols). Zmodem is the recommended protocol for most transfers.

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Chapter 4 - Command Mode

MultiTech Systems

4.1   Introduction

AT commands are the means by which you, and your communications software, are able to communicate with and configure your modem. They enable you to establish, read, and modify parameters in addition to dialing. The following provides both a summary and a detailed explanation of the AT commands recognized by the MultiModem.

4.1.1   AT Command Editing

The **BACKSPACE** key on your keyboard can be used to edit characters in the AT command line. An AT command is not executed until the RETURN key is pressed. The BACKSPACE key erases the previous character for reentering.

The **BACKSPACE** key does **not** erase the **AT** characters once they are entered. If your keyboard has no **BACKSPACE** key, **CTRL-H** does the same thing. The character recognized by the modem as **BACKSPACE** may be changed to any other ASCII character with S-Register S5.

If you wish to cancel an entire command that has been entered but not yet executed, enter **CTRL-X**. This also clears the command buffer. The effect is the same as backspacing to cancel the entire command, only quicker.

Characters entered in a command are stored in the modem's Command Buffer (*memory*) until executed by hitting RETURN. The Command Buffer's capacity is sixty characters. The Attention Characters **AT** do not count in the sixty allowed Command characters. Spaces, which may be used for increased display readability, may be used when entering a command, but are not stored in the Command Buffer and are not counted in the sixty allowed characters. Hyphens, parentheses, etc. are not allowed.

If the sixty character limit is exceeded or if invalid characters are entered, the Command Buffer automatically erases, and an **ERROR** message appears. You would then re-enter your command within the sixty-character maximum, using only the allowed characters.

4.1.2   Functional Modes

The MultiModem can be in one of two functional states (see Figure 4-1). These are *"Command mode"* and *"On-line mode"*. (There is also an in-between state, *"Wait-for-Carrier"*, where the modem is out of Command mode but not yet really On-Line.

When the modem is initially powered up, it is in Command mode and is ready to accept commands from your keyboard or software. The modem enters On-line mode after dialing, making a connection with another modem, and then detecting a valid carrier signal. If no carrier is detected within a certain time frame, the modem abandons the call and re-enters Command mode.

Once on line, the modem exits On-line mode if one of two conditions is met. If the carrier is lost or intentionally dropped, the modem hangs up and re-enters Command mode. Also, if the modem recognizes the Escape sequence for which it is configured (i.e., either the Escape characters in the serial data stream, the Remote Escape characters in the modulated data stream, or the Break signal), the modem will exit On-line mode, retain the datacomm link, and enter Command mode.

You can force the modem into On-line mode without dialing by sending the **ATD** or **ATA** command to the modem.
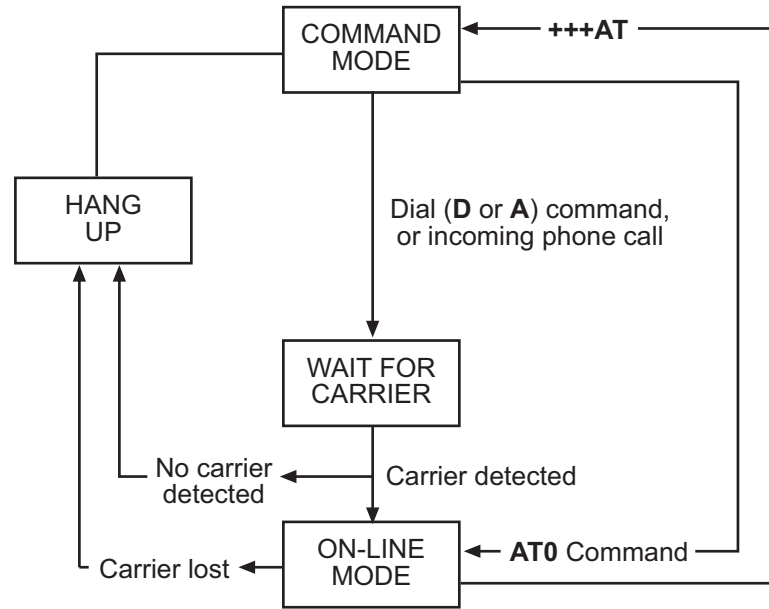
Figure 41. Functional Modes

4.2   Summary of AT Commands

A wide variety of autodial operations and modem options can be controlled when the modem is in Command Mode. Remember, nearly all commands begin with *AT*.

These commands are organized into several functional groups. An alphabetical summary of commands is provided in Appendix D.

HOW TO	COMMANDS	
DIAL	*D*	Dial
	A: or :	Continuous Redial
	$D	DTR Dialing
	$VD	Voice/Data Dialing
	N	Dial a Stored Number
MODIFY DIALING	*P/T*	Pulse/Tone Dialing
PROCEDURES	*&P*	Set Pulse Dial Ratios
	,	Automatic Pauses in dialing
	Y	Long Space Disconnect
	W	Wait for New Dial Tone
	;	Return to Command Mode After Dial Command
	R	Reverse Mode of Operation
	!	Flash On Hook
	$	AT&T *"Calling Card"* Tones
	@	Quiet Answer
MEMORIZE PHONE		
NUMBERS	*D...N*	Store Phone Numbers
	NN	Number Linking
	L	List Numbers Stored in Memory

STORE MODEM	**&F**	Load Factory Defaults
CONFIGURATIONS	**&W**	Store Configuration & S-Register
AND DEFAULTS		Parameters
	Z	Reset Modem
	V	Result Code Terse/Verbose
	$SP	UNIX/*"Spoofing"*
	&M	Synchronous/Asynchronous Mode Select
	&X	Synchronous Transmit Clock Select
CONFIGURE	**Q**	Result Codes Enable/Disable Response
COMMAND	**&Q**	Result Code Selection
RESPONSES	**E**	Echo Command Characters
	V	Result Code Terse/Verbose
	X	Result Code...Basic/Extended/Call Progress
CONDITION	**&G**	Guard Tones
PHONE LINE	**M**	Monitor Phone Line
	&T	Remote Digital Loop Signal
	#T	Enable/Disable Trellis Coded Modulation
	B	Bell/V.21 Tones
	#F	Fallback When On-Line
	&CD	Cleardown at Disconnect (2834 Series only)
	#A	Auto-Speed Detect
CONTROL RS232C	**&C**	Carrier Detect Control
INTERFACE	**&D**	Data Terminal Ready Control
	&R	Clear To Send Control
	&S	Data Set Ready Control
	&RF	CTS/RTS Control
	&SF	DSR/CD Control
CONFIGURE	**&E0**	Normal Mode
ERROR	**&E1**	Auto-Reliable Mode
CORRECTION	**&E2**	Reliable Mode
	#L0	Negotiate V.42 Mode During Handshake
	#L1	MNP On/LAPM Off
	#L2	LAPM On/MNP Off
	#L3	Direct LAPM/Phase Out Handshake
	$A	Auto-Reliable Buffering
	$F	Enable/Disable Auto-Reliable Fallback Character
	$R	Retransmit Count
	$E	Error Correction at 300 bps
CONFIGURE	**&E3**	Flow Control Disabled
FLOW CONTROL	**&E4**	Hardware Flow Control
	&E5	Xon/Xoff Modem-Initiated
	&E6	Xon/Xoff Modem Responds/No Pass-Through
	&E7	Xon/Xoff Modem Responds/Pass-Through Allowed
	#X	Send Single/Multiple Xoff Characters
	&E8	Enq/Ack Off
	&E9	Enq/Ack On
	&E10	Normal Mode Modem Flow Control Off
	&E11	Normal Mode Modem Flow Control On
	&E12	Computer-Initiated/Off
	&E13	Computer-Initiated/On
	&BS	Maximum Block Size
	$EB	10/11 bit Asynchronous Format
	#P	Parity Selection

CONFIGURE DATA	**&E14**	Data Compression Disabled
COMPRESSION	**&E15**	Data Compression Enabled
CONFIGURE SPEED	**$BA0**	Speed Conversion On
CONVERSION	**$BA1**	Speed Conversion Off
	$MB	Set modem speed (e.g.,$MB14400)
	$SB	Set serial port speed (e.g.,$SB57600)

EXECUTE	**$H**	Help
IMMEDIATE	**I**	Product Code Inquiry
ACTION	**I 9**	Windows 95 Autodetect Inquiry (2834 Series only)
COMMANDS	**L5**	List Current Operating Parameters
	L6	List S-Register Values
	L7	List additional Configuration Parameters
	L8	List On-Line Diagnostics
	H	Off Hook
+++AT<CR>		Escape Sequence: Entering Command Mode while On-Line
	%E	Escape Sequence Options...Entering Command Mode while On-Line
	A	Force Answer Mode
	O	Exit Command Mode/Go Back On-Line

EXECUTE	**%DF**	Format Line Probe Display (Graph or Table Format)
LINE	**%DP**	Enable/Disable Reading Line Probe From DSP during handshake
PROBE	**L9**	Display of Signal Strength Information
COMMANDS	**L10**	Display Signal to Noise Ratio (*SNR*)
(2834 Series only)	**L11**	Display of Noise Information
	&RP	Initiates Retrain to Read Line Probe Parameters

READ AND	**Sr?**	Read Current S-Register Value
ASSIGN	**Sr=**	Assign S-Register Value
S-REGISTER		
VALUES		

REMOTE	**#CBN**	Passwords for Callback Phone Numbers
CONFIGURATION	**#DB**	Callback Security Enable/Disable
& CALLBACK	**#I**	Change LOGIN Password
SECURITY	**#RCBNxx**	Erase Password Linked with Memory Location *xx*
	#S	Change SETUP Password

TEST MODEM	**U**	Self-Test Modem (Chapter 8)
	&T	Enable/Disable Digital Loopback Signal

4.3   Result Codes

The Command mode provides you with several responses, or *"Result Codes"*, that can aid you in Command mode operation. These Result Codes are displayed on your video monitor.

You can choose result codes that closely match those of the standard AT command set, or choose enhanced function result codes that have been used in Multi-Tech modems (*"Multi-Tech"* responses). The **&Q** command selects which result codes will be used.

You can choose to have these Result Codes displayed in either *"verbose"* (full words) or *"terse"* (digits) format. This is controlled by the **ATV0** (terse) or **ATV1** (verbose) commands. The modem defaults to verbose format.

AT&Q0 selects Multi-Tech responses with Reliable/LAPM/Compression modifiers. The terse response code for *CONNECT 2400* is *9.* **AT&Q1** selects Standard AT command set responses. The terse result code for *CONNECT 2400* is *10.*

The following tables define the result codes generated by the **&Q** command (refer to Appendix G for Result Code Summary).

"Multi-Tech" Result Codes

TERSE	VERBOSE	TERSE	VERBOSE
0	OK	11*	CONNECT 4800
1	CONNECT	12*	CONNECT 9600
2	RING	13*	CONNECT 14400
3	NO CARRIER	19*	CONNECT 19200
4	ERROR	21*	CONNECT 21600
5*	CONNECT 1200	24*	CONNECT 24000
6	NO DIALTONE	26*	CONNECT 26400
7	BUSY	28*	CONNECT 28800
8	NO ANSWER	31*	CONNECT 31200
9*	CONNECT 2400	33*	CONNECT 33600

* With MNP error correction on, RELIABLE (or R) is added to these result codes. With LAP-M error correction on, LAP-M (or L) is added to these result codes. With data compression on, COMPRESSED (or C) is added. (Note these *"Extended"* Result Codes are displayed when your modem is set up to do so with an X1, X2, X3, or X4 command.)

"Standard AT" Result Codes

TERSE	VERBOSE	TERSE	VERBOSE
0	OK	11	CONNECT 4800
1	CONNECT	12	CONNECT 9600
2	RING	13	CONNECT 14400
3	NO CARRIER	19	CONNECT 19200
4	ERROR	21	CONNECT 21600
5	CONNECT 1200	24	CONNECT 24000
6	NO DIALTONE	26	CONNECT 26400
7	BUSY	28	CONNECT 28800
8	NO ANSWER	31	CONNECT 31200
10	CONNECT 2400	33	CONNECT 33600

*Reliable/Compression modifiers are not displayed with Standard AT Result Codes.

4.4   Dialing Commands

4.4.1   Dialing Action Commands

Dial Command D

The letter **D** in a command causes the modem to dial the telephone number immediately following it. For example, if you enter **ATD5551212** and hit RETURN, the modem dials the number 555-1212.

The **D** command is also used in conjunction with a telephone set for manual dialing. You dial the number on your telephone set, and after hearing the answer tone on your handset, you type **ATD** on your keyboard and hit RETURN. Then hang up the headset. Unless you have a specific need to dial in this manner, we recommend you use the first method, where the telephone number is entered on your keyboard.

The modem gives you several choices of dialing methods. You can use tone or pulse dialing, by inserting a letter **T** or a **P** in the command string.

You can also configure the modem to either wait for and detect dial tones and busy signals (which we call *"Wait-for-Dial-Tone"* dialing or *"Smart"* dialing), or work with timed pauses without dial tone and busy signal detection (which we call *"Blind"* dialing; see Section on *"X"* Command.)

Note: There is another method of dialing, called *"DTR Dialing"*, where by manipulating the DTR signal on pin 20 of the RS-232C/V.24 interface, a number stored in the modem's memory is automatically dialed. See description of **$D** command (in this section) for details.

Continuous Redial (not used in BAI) A: or :

If you select the Wait-For-Dial-Tone method of dialing (see X3 or X4 command), you can command the modem to continuously redial (up to 10 re-dials for DOC units) a busy number until your call is answered. This is done with the **A:** command.

This command would be used only if you had already reached a busy number after executing a normal dial command. You simply enter **A:** (you need not enter AT, nor do you need to hit RETURN), and the modem will redial the number for you. If you again reach a busy signal, it re-dials again and again until it no longer detects a busy signal. You can stop the modem from re-dialing by pressing any key.

Another method used to cause the modem to redial a phone number continuously is to enter a colon **:** at the end of the phone number. The result is the same as if you had entered **A:** after personally observing that the number was busy on the first dialing attempt. Using the colon in the dialing string is a step saver.

Dialing a Stored Number N

A telephone number that you have stored in the modem's number memory may be automatically dialed by entering **ATNn** where n = 0, 1, 2, 3, 4, 5, 6, 7, 8 or 9. For example, a number stored at N3 would be dialed by entering **ATN3** and RETURN. Do *not* include the letter D in this command, or the stored number will be erased.

DTR Dialing $D

An alternate method of causing the modem to automatically dial is DTR Dialing. Data Terminal Ready (DTR) is a signal that comes into the modem from the terminal or computer to which it is connected, on pin 20 of the RS-232C interface. In DTR dialing, the modem automatically dials a stored number as soon as it receives a high DTR Signal. The DTR dialing method is popular in synchronous applications.

To activate DTR Dialing, enter **AT$D1** and hit RETURN. The modem dials the phone number stored in the N0 location of memory when it receives a high DTR signal. DTR must remain high for the duration of the call, until disconnect. To deactivate DTR dialing, enter **AT$D0** and hit RETURN.

Note when using DTR Dialing in a synchronous application, be sure DIP-Switch #8 is in the UP position to disable V.25*bis* Command mode.

Voice/Data Dialing $VD

Another alternate method of causing the modem to automatically dial is Voice/Data Dialing. With Voice/Data Dialing, the modem automatically dials the phone number stored in the N1 position of memory whenever the Voice/Data switch is toggled. You must first enter **AT$VD1&W0<CR>**. This command string enables Voice/Data dialing when the Voice/Data toggle switch is activated. To disable Voice/Data Dialing (default), enter the command *AT$VD0* **W0<CR>**.

4.4.2   Dial Modifier Commands

There are several command characters that can be included within a dialing command (following the letter *D*), called *"Dial Modifiers"*. They have various functions, including the selection of Pulse or Tone Dialing, pauses in the dial sequence, automatic re-dials if a number is busy, and reverting to the Command mode or switching to the Answer mode after dialing.

Pulse or Tone Dial P T

The modem dials numbers using either pulse or tone dialing, or a combination of both methods. Pulse dialing is a method used by rotary-dial telephones, which involves the timed opening and closing of line relay.

Tone dialing is the method used by push-button (*touch tone*) telephones, and is sometimes referred to as DTMF, or Dual-Tone Multi-Frequency dialing.

The method used is selected by including a **P** for **Pulse** or a **T** for **Tone** in the dialing command, right before the digits you wish to have dialed in that manner.

For example, you would pulse-dial the number 555-1212 by entering ATDP5551212 and hitting RETURN. You could tone-dial the same number by entering ATDT5551212 and hitting RETURN. If neither Pulse nor Tone dialing is specified in the dial command, the modem uses whatever method used last. If the modem has been reset or just powered up, it uses Pulse dialing, even if the letter P is not included in your dial command.

Nearly all telephone systems in the U.S. are now compatible with tone dialing. Since that is the faster method, you will probably choose the tone method for your dialing.

An example of combining pulse and tone dialing could involve a PBX system where 9 had to be pulse-dialed first, then the rest of the number tone-dialed after pausing for a second dial tone. The number would be dialed by entering *ATDP9*, *T5551212* and RETURN. (The comma causes a pause, which we'll explain soon.)

Set Pulse Dial Ratios &P

This command sets the time ratios between the open and closed portions of the dialing pulse frequencies. To set the dialing pulse ratio of 60 mSec to 40 mSec, enter *AT&P0.* To set a ratio of 67 mSec to 33 mSec, enter *AT&P1*. The factory default is *&P0*.

Automatic Pauses in Dialing ,

You can cause the modem to pause during the dialing sequence by entering a comma character where the pause is desired. This pause lasts two seconds. If a longer pause is desired, more than one comma may be entered consecutively, with each comma causing a two second pause. You also have the option of changing the length of the pause caused by the comma, from two seconds to any other value from 0 up to 255 seconds. This is done by setting S-Register S8 (refer to Chapter 6). Each comma in a dialing command counts as one of the sixty allowed characters.

Long Space Disconnect Y

When two modems are connected in Normal mode (i.e. without error correction) there is no *"polite"* means of requesting a disconnect. A link disconnect request packet is sent under reliable connections. As a result some *"garbage"* may be received when a hang-up command is issued. The **Y1** command enables the modem to use the break signal which accomplishes the hang-up as an instruction to shut off its receiver and disconnect (both modems must have **Y1** enabled for this feature to be effective). **Y0** (factory default) disables this function.

Wait for New Dial-Tone W

A *W* inserted in the dialing command causes the modem to wait for another dial tone, and not resume dialing until another dial tone is detected.

It is not necessary to enter a *W* at the beginning of the dialing command to wait for a modem dial tone, because the modem will do that first (pause automatically).

In order for this command to work, you must select Wait-For-Dial Tone dialing with the *X2* or *X4* command, so that your modem will be able to detect the dial tone.

Return to Command Mode After Dial Command Execution ;

A semicolon (*;*), entered as the last character of a dialing command causes the modem to return to the Command mode immediately after executing the command, instead of waiting for a carrier signal and going on line.

For example, entering *ATDT5551212;* would tone-dial the number, and do nothing afterwards except go back into Command mode. This can be useful in dialing applications where modem data transfer is not desired, such as voice communications, or in applications involving the use of touch tones as a data entry method, such as bank-by-phone.

Reverse the Mode of Operation R

In certain operations you may need to reverse the mode of operation for your modem from originate to answer or answer to originate so that it would answer the phone and go into answer mode. This command turns off the reversing function with the *R0* command and turns it on with the *R1* command with the modem in either command mode. If you want to reverse from the originate mode, use *R* (with no number) in the dialing string.

Flash On Hook !

Some switchboard systems react to a momentary On Hook. An exclamation mark inserted in the command causes the modem to *"flash"* on hook for a half of a second, as if you had held the switch hook button on a telephone down for a half second.

For example, to flash On Hook after dialing the number 555-1234 in order to transfer to Extension #5678, you might enter **ATDT5551234,,!5678**. The commas cause a 4 second pause (just to be safe).

"Calling Card" Detect Tones $

The modem has the capability to detect AT&T *"calling card"* tones for the purpose of utilizing the user's calling card number to originate an on-line connection. An **$** symbol placed in the dialing string causes the modem to pause and wait for an AT&T *"calling card"* or a 1600 Hz tone (prevalent in the United Kingdom). When the tone is detected, the rest of the dialing string is processed. If no tones are detected within the time period set by S-Register S7 (default 45 seconds), the modem will abort by indicating a *NO CARRIER* message. Hitting any key also aborts the **$** command.

The following is an example of this command:

$$\text{ATDT}\underset{\text{(access/phone number)}}{1028806127853500}\mathbf{\$}\underset{\text{(credit card number)}}{123456789}$$

Quiet Answer @

The **@** command causes the modem to wait before processing the next symbol in the dialing string. The wait is for one or more ringbacks followed by 5 seconds of silence. If the time specified by S-Register S7 passes before the rings and silence, a *NO ANSWER (R)* result code is processed. The **@** command is used for accessing a system that does not provide a dial tone.

For example, **ATDT5551212@6313550** causes the modem to dial the first number (555-1212) and wait for the time specified in **S7** for at least one ringback and 5 seconds of silence. If a busy signal is detected, the modem hangs up and generates a *BUSY* result code. If it does not detect 5 seconds of silence, a *NO ANSWER* result code is generated after hanging up. If 5 seconds of silence is detected, the second number (631-3550) is then dialed.

4.4.3   Phone Number Memory Commands

Storing Phone Numbers D...N

A telephone number and command line of up to sixty characters may be stored in the modem's number memory. As many as ten of these numbers may be stored. Each number will be given a name, using the codes N0, N1, N2 up to N9.

A phone number is stored by entering **ATD**, then the number as it would be dialed, along with any **P, T, R, ;** or comma characters, and then entering **N** followed by the number's *"name,"* which would be any number from 0 through 9, and then hitting RETURN.

For example, the tone-dialed number 1-612-631-3550 would be stored as number **N3** by entering **ATDT16126313550N3** and RETURN. The number is **not** dialed with this store command. After storing a number, check to see that it has been stored correctly by typing **ATL** and hitting RETURN.

When phone numbers are stored, the entire command line is also stored so that you can effectively create a macro for each number. For example, if you know a particular number needs to have extended result codes, detect busy or dial tone, error correction, Xon/Xoff flow control, pacing, and data compression enabled, the command line would be:
ATX4&E1&E5&E13&E15DT16126313550N3. This would store the entire command at location **N3**.

Number Linking NN

You may command the modem to dial another number automatically if the first number dialed is busy. This would be useful in a situation where a computer can be accessed through more than one phone number. This is called *"linking"*.

To link the number in N1 to the number N2, simply enter **ATN1N2** and hit RETURN. Several numbers can be linked in the same command. For example, you could link N1 to N2 to N3 to N4 by entering **ATN1N2N3N4** and RETURN or you could link N1 to N2 and back to N1 and then back to N2 by entering **ATN1N2N1N2** and RETURN.

The only limit on the number of numbers that can be linked is the 60 characters allowed in a command line. Number linking can not be used with blind dialing, since busy signals would not be detected. You would have to select the Wait-for-Dial tone dialing method using the *X* Command in order to use the Number Linking feature.

Listing Numbers Stored in Memory L

Telephone numbers that you have stored in the modem's memory may be listed and displayed with the **L** command. It will display all ten stored N numbers in a format like that shown below. All digits and command letters will be shown. The number's *"name"* (0 thru 9) is shown first, followed by the complete dialing command and telephone number as originally entered.

Simply enter *ATL* and hit RETURN to display these numbers on your video screen or printer. An example of an **L** command listing is shown below:

> *0   DT14082345678*
> *1   DT16125551212;*
> *2   DP9,T14089876543*
> *3   DT3738315,12101,16126313550*
> *4   DT6313551R*
> *5*
> *6   DP9,4258513*
> *7*
> *8   DTX4&E1&E5&E13&E15DT16126313550*
> *9   DT12138880123*

4.4.4   Configuration and Default Storage Commands

Store Configuration & S-Register Parameters in Non-Volatile Memory &W

The modem can store configuration parameters and S-Register values in its nonvolatile read/write Random Access Memory (RAM) memory. The **&W** command does this, which prevents any re-configuration from being lost on a power-down or Reset (*ATZ*) condition.

&W0 (or **AT&W**) causes the modem to store your customized AT command settings and S-Register values in its nonvolatile RAM. *&W0* also sets the modem so that it reads your customized settings stored in nonvolatile RAM when powered down or reset. (The *&W0* command only changes the settings stored in nonvolatile RAM that you specifically intend to alter. All other default parameters are applicable.)

&W1 causes the modem *not* to store your customized settings to nonvolatile RAM so that, after powering down or resetting the modem, it reads the factory default settings stored in ROM.

Loading Factory Defaults &F

The *&F* command provides a choice between customized configuration settings in RAM and the factory default configuration settings in ROM. The *&F8* and *&F9* commands define the function of the *&F* command.

The modem is shipped from the factory with a pre-configured set of command and S-Register default settings. This set of factory defaults can be recalled by issuing the *&F* command.

In addition to being able to recall the factory-installed defaults, the *&F* command can also recall those defaults stored under *&W0*.

This is done using the *&F9* command. If you have stored parameters with the *&W0* command and wish these settings to always be used as your defaults, you would enter *&F9&W0*.

To return the *&F* command to read factory installed defaults, enter *&F8&W0*. *&F8* is the factory default.

Many datacomm program issue the *&F* command automatically- the *&F9* command allows the user to select their own factory defaults. Note that the *&F8/&F9* commands should be used with *&W0*.

Following is a summary of how the **&F** and **Z** reset commands interact with the **&W** command; note how the **&F** reset command operates differently from the **Z** reset command:

Previous Command	AT&F	Power-On and ATZ
AT&W1 (default)	ROM	ROM
AT&W0	ROM	NVRAM
AT&F8&W0	ROM	NVRAM
AT&F9&W0	NVRAM	NVRAM

Modem Reset Z

The *Z* command can be used to reset the entire Command Mode buffer and the result is the same as if you had disconnected, and then reconnected power to the modem. When an *ATZ* command is executed, the state of the &W command determines where the default values originate. *&W0* defaults come from RAM and *&W1* defaults come from ROM.

Unix UUCP Spoofing $SP

The modem can be configured in a Unix environment that employs ACK flow control as a means of monitoring data integrity. The modem can do *"UUCP spoofing"*, where the modem is able to generate ACKs at the DTE interface. Data is transmitted more time efficiently because the delay of waiting for data to be received, then for an ACK to be returned at the remote end, is eliminated. The *$SP1* command enables UUCP spoofing and the default command *$SP0* disables UUCP spoofing.

Async/Sync Mode Switching &M

This command can be used to set the on-line mode to either synchronous or asynchronous. *AT&M0* will set the modem to Asynchronous mode, and all communications will be Asynchronous, in both On-line and Command modes. *AT&M1* causes the modem to communicate asynchronously when in Command mode and switch to synchronous mode while on-line. The modem defaults to *&M0* (asynchronous communications) on reset or power-up.

Synchronous Transmit Clock Select &X

The **&X** command selects the Synchronous Transmit Clock Source in conjunction with DIP-Switch #11. DIP-Switch #11 in the UP position enables External clocking. DIP-Switch #11 in the DOWN position enables Internal clocking (default position). External clocking is when the DTE provides transmit clocking to the modem on pin 24 of the RS-232C interface.

&X0 is the default setting, which allows DIP-Switch #11 to control Internal/External Clocking (default Internal). Internal clocking is when the modem provides transmit clock to the DTE on pin 15 of the RS-232C/V.24 interface. The **&X1** command overrides DIP-Switch #11 and selects External clocking. If DIP-Switch #11 is UP (External clocking), you can not override Internal clocking. **&X2** enables Slave Clocking. The &X2 Command causes the modem to generate the transmit clock timing (pin 15) from the receive clock (pin 17) from the DTE (therefore 15 and 17 are the same). In this mode (Slave Clocking), all timing is controlled by the receive clock.

4.4.5   Command Response (Result Code) Commands

Echo Command Mode Characters E

If the modem is connected to a full-duplex computer, it may be necessary for the modem to be configured to echo back characters entered while in the Command Mode in order for them to be displayed. The **E** command is used to configure the Command Mode echo, with **ATE0** disabling the echo and **ATE1** enabling the echo (default).

Result Codes Enable/Disable and No Response Answer Q

The *Q* command enables or disables Result Codes and the No Response Answer mode of operation. Result Codes may be disabled altogether in certain applications, such as computer-controlled auto dialing, using the *Q* command. *ATQ1* disables Result Code transmissions. *ATQ0* (or *ATQ*) enables Result Code transmission.

Regarding No Response Answer, you may want the answer mode handled without responses and echo turned off, but want the originate mode still intelligent. This is called the No Response Answer mode. *ATQ2* selects the No Response Answer mode. If you do not select any mode, the factory default setting (enable Result Codes) is automatically selected.

Result Codes ("Multi-Tech" or "Standard AT") &Q

The modem gives you a choice between the Multi-Tech Result Codes, and Result Codes that more closely match the standard AT command set responses.

AT&Q1 selects **AT responses** with no Reliable/Compression modifiers. With this command, the terse result code for *CONNECT 2400* is *10*.

AT&Q0 selects **Multi-Tech responses** with Reliable/Compression modifiers. With this command, the terse result code for *CONNECT 2400* is *9*.

Result Codes (Verbose/Terse) V

The **V** command controls whether the modem's result codes are displayed as word (*"verbose"*) or single digit (*"terse"*) messages.

For example, if after dialing, no carrier signal is detected, the resulting message can be displayed either as *NO CARRIER*, or as the digit *3*.

Entering *ATV0* (or *ATV*) causes the modem to display the Result Codes as digits, while *ATV1* displays them as words. If you do not select a method, the factory default setting causes the modem to display Result Codes as words.

Result Codes (Basic and Extended) and Call Progress Selection X

The *X* Command is used to select one of two possible dialing methods (*"dumb"* or *"smart"*), and to select various response combinations related to these methods. You can choose to have certain responses suppressed, or whether or not you want speed indications along with the CONNECT responses. You can also pick and choose certain responses in order to match up with *"Standard AT"* responses.

The modem provides *"Basic"* and *"Extended"* Result Code sets. The difference between the two is the Basic set provides one response (*CONNECT*) to indicate a connection, while the Extended set provides several responses for different speeds (*CONNECT, CONNECT 2400, CONNECT 4800, CONNECT 9600, Etc.*).

When the Extended set is chosen, you also have the option of matching them up with Standard AT 2400 response code sets, by including or not including the BUSY and/or NO DIAL TONE responses while excluding the DIAL TONE response. The *X* command is used to select which responses are provided.

Regarding the modem's method of dialing, the modem can detect standard dial tones and busy signals. This capability (*"smart dialing"*) allows the modem to wait for a dial tone, and when one is detected, to begin dialing immediately.

The modem also can detect a distant busy signal, if after dialing, it reaches a busy number. This is useful because it allows the modem to immediately abandon a call, rather than wait 45 seconds for a carrier signal that will never come. S-Register S7 defines the wait for carrier time (refer to Chapter 6).

The modem gives you a choice between the **wait-for-dial-tone** (*"smart"*) method we just described, and **blind** (*"dumb"*) **dialing**, where instead of detecting actual dial tones, the modem relies on timed pauses. When the wait-for-dial-tone method is chosen, the busy signal detection capability is also activated. The *X* command is also used to select which dialing method is used.

Five different *X* commands are available (X0 through X4), with five different effects on the modem's Result Codes.

> **X0** Provides the basic (short) result codes and provides *"dumb"* dial capabilities.
> **X1** Provides the extended result codes and provides *"dumb"* dial capabilities.

The remaining *X* commands affect Call Progress, and turn on Extended Result Codes.

> **X2** Looks for *dial tone only* and will not provide a busy response.
> **X3** Looks for busy only and not look for dial tone.
> **X4** Looks for dial tone and for busy.

The factory default setting is **X0,** which selects Basic Result Codes and the blind (*"dumb"*) method of dialing.

4.4.6   Phone Line Conditioning Commands

Guard Tones (Not Used in BAI Models) &G

The *&G* command is used to control the presence or absence of guard tones from the transmitter when in Answer mode, at either 1200 or 2400 bps. Guard tones are used in Europe and other areas for the modem to function in the telephone systems. Guard tones are not used in the United States. *&G0* (default), turns off CCITT guard tones. *&G1* turns on 550 Hz guard tones. *&G2* turns on 1800 Hz guard tones. This command is not used in international models.

Bell/V.21 Tone   B

The *B* command selects the frequency that the modem uses for its answer tone. (The answer tone is the tone transmitted by a modem receiving a call to the modem that called it, which initiates the handshaking between the two modems.) At higher speeds there is no conflict, because all use CCITT frequencies. At lower speeds (0-1200 bps), in the U.S., some modems use the Bell frequency of 2225 Hz. However, the CCITT specification for V.22 has an answer tone frequency of 2100 Hz.

The *ATB0* command enables CCITT frequencies including V.21 (300 bps) and V.23 (1200/75 bps). The *ATB1* command enables Bell frequencies including Bell 103 (300 bps). The modem default is *ATB0*.

Phone Line Monitoring Speaker M

The modem has an internal on-board, speaker which functions like the speaker in a telephone handset to enable you to monitor phone line activity. The *M* command can be used to determine when the speaker is operational.

Entering *ATM0* disables the speaker completely, while *ATM1* causes the speaker to be on only until a carrier signal is detected. *ATM2* causes the speaker to remain on at all times. *ATM3* causes the speaker to be on during dialing and off during handshake. *ATM1* is the default setting, and the one that should be used in most applications.

Enable or Disable Recognition of Remote Digital Loop Signal &T

The modem has several self-test features (covered in Chapter 8). The tests are activated with different *U* commands, such as *ATU1*, and so forth. The *&T* command is a phone line conditioning command that enables or disables the modem's ability to recognize the Remote Digital Loop (*RDL*) test signal.

The *AT&T4* command lets the modem respond to a RDL signal, and places itself in digital loop. The *AT&T5* command causes the modem to ignore the RDL signal. The factory default is *&T5*.

Enable/Disable Trelis Coded Modulation #T

This command enables or disables the Trellis Coded Modulation of the modem. There is usually no need to disable (turn off) Trellis codings except under an unusual line condition called impulse noise. **AT#T0** turns Trellis coding off and **AT#T1** turns Trellis coding on (factory default).

Fallback Modes When On-Line #F

If line conditions deteriorate, the modem automatically drops its transmission speed (*"fallback"*). The *#F* command controls the different ways the modem falls back. During operation, if the error rate becomes too great, the modem performs a retrain. If after the retrain, the error rate is still too high for 33600 bps operation, the modem initiates a retrain at 4800 bps. If after the first retrain the modem returns on line at 33600 bps , the modem then starts a counter and a timer. If three retrains occur within a two minute period, the modem falls back to 4800 bps.

Entering *AT#F0* (or *AT#F*) allows no fallback when on-line.

AT#F1 allows the modem to fallback (based on the error rate or if three retrains have occurred within a two minute period) from:

> 33.6K to 31.2K to 28.8K to 26.4K to 24K to 21.6K to 19.2K to 16.8K to 14.4K to 12K to 9.6K to 4.8K bps.

The *AT#F2* command enables incremental fall back, but also enables incremental fall forward if the phone line improves. *AT#F2* is the factory default setting.

Enable/Disable Lowspeed Fast Connect $FC

Entering **AT$FC0&W0<CR>** sets up the data pump so that it will not transmit a 5 second 2100 Hz signal. Entering **AT$FC0&W0<CR>** allows the modem to transmit a 5 second 2100 Hz signal and is the factory default.

Cleardown at Disconnect &CD

The **&CD** command is used for control of cleardown at disconnect in V.32, V.32bis, V.34 and V.34 enhanced modes.

A cleardown usually adds 1-2 seconds to the time it takes for the modem to go on-hook after a disconnect. A cleardown makes a disconnect by the remote modem easier to detect and a subsequent re-connection more likely. Enter **AT&CD0&W0<CR>** to execute a cleardown at disconnect (default); and enter **AT&CD1&W0<CR>** to disable the cleardown function.

Auto Speed Detect #A

The function of the **#A** command is to detect and select the operational data rates (the *"starting"* speeds) with which the modem uses for initial handshake and speed selection.

Remember, this command does not control the originating data rate of the modem (that is done by the Modem Baud Rate command **$MBn**), but only the Answer mode *"starting"* speeds.

Entering **AT#A0** (or **AT#A**) causes the modem to operate starting at:

33,600 bps, with fallback to 28,800 to 19,200 to 14,400 to 9600 to 4800 to 2400 to 1200 and to 300 bps.

Entering **AT#A1** causes:

33,600 bps operation only.

Entering **AT#A2** causes the modem to operate at starting speeds of:

 33,600 bps, with incremental fallback to 28,800, 19,200, 14,400, 9600 and 4800 bps.

The **AT#A3** command causes the modem to begin operation as a V.22*bis* modem at 2400 bps, with fallback to 1200 to 300 bps. **AT#A0** is the factory default value.

4.4.7   RS-232C Interface Control Commands

Carrier Detect Control &C

The **&C** command allows you to control the status of the Carrier Detect signal (CD-Pin 8) on the RS-232C line. You have four choices.

You can force the signal high, or allow it to act normally, or force the modem to reset when CD drops, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CD to act in this manner.

To allow CD to act normally, enter the command **AT&C1** (the factory default setting). To force CD on, enter **AT&C0**. To reset the modem to its current parameters when CD drops, enter **AT&C4**. To set up CD so that it drops for one second on disconnect and then comes up again, enter **AT&C2**. (If you want the drop time to be something other than one second, use S-Register S24 to change this value. Refer to the Chapter 6 instructions for S24.

Data Terminal Ready Control &D

Data Terminal Ready (DTR) on pin 20 of the RS-232C interface is required in order for the modem to operate. A high DTR signal tells the modem that the device to which it is connected is active, or *"ready"* to communicate through the modem. If the signal is not being provided on the RS-232C interface, you can force DTR high with DIP-Switch #1.

DTR has some other modem functions. DTR can be used to trigger a dialing sequence, called DTR Dialing. The condition of DTR can also be used to cause the modem to reset to its default parameters, just as if you had given the modem an ATZ command. To do this, enter the command *AT&D3* and hit RETURN.

The modem will now reset itself whenever DTR is dropped from On to Off, and will also go on-hook (hang up) if it is on-line.

Entering *AT&D0* or *AT&D* causes the modem to ignore DTR. Entering *AT&D1* causes the modem to go on-hook (*hang up*) with loss of DTR. The modem enters Command mode when DTR goes high again. Auto-answer is disabled while DTR is low. Entering *AT&D2* causes the modem to go on hook with loss of DTR. The modem enters command mode when DTR goes high again.

CTS Control &R

The *&R* command allows you to control the Clear to Send signal (CTS-Pin 5) on the RS-232C interface. You have three choices. You can force the CTS signal high, allow it to act normally, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require CTS to act in this manner.

To allow CTS to act normally, enter the command *AT&R0*. To force CTS on, enter the command *AT&R1* (this is the factory default setting). When the modem goes on-line, CTS still provides flow control. To set up CTS so that it drops for one second on disconnect and then comes up again, enter the command *AT&R2*. (If you want the drop time to be something other than one second, use S-Register S24 to change this value.

Data Set Ready Control &S

The *&S* command allows you to control the status of the Data Set Ready signal (DSR - pin 6) on the RS-232C interface. You have three choices. You can force the signal high, allow it to act normally, or set it to stay high until the modem disconnects, go low momentarily, and then go high again. The last option is useful with some CBX phone systems and mainframe front ends, which require DSR to act in this manner.

To allow DSR to act normally, enter the command *AT&S1* (the default setting). To force DSR on, enter the command *AT&S0*. To set up DSR so that it drops for one second on disconnect and then comes up again, enter *AT&S2*. If you want the drop time to be something other than one second, use S-Register S24 to change this value.

CTS/RTS Interaction Control &RF

In typical operation, Clear to Send follows Request to Send when the modem is on-line. In other words, if RTS goes off, CTS goes off in response. The *&RF0* command enables CTS to follow RTS. In some applications, however, it may be necessary for CTS to operate independent of RTS. *&RF1* allows CTS to operate independently regardless of the state of RTS, and is the factory default. If this is the case, refer to the *&R* command for control of the Clear to Send signal.

DSR/CD Interaction Control &SF

In typical applications, Data Set Ready (DSR) follows Carrier Detect (CD). *&SF0* enables DSR to follow CD, and is the factory default. *&SF1* enables DSR to operate independent of CD. If this is your application, refer to the *&S* command for control of the Data Set Ready signal.

4.4.8   Error Correction Commands

You can use AT commands to place your modem one of three V.42 (error correction) modes of operation. These are the **Normal, Auto-Reliable,** and **Reliable** modes.

Normal Mode &E0

In Normal mode of operation, the modem's V.42 error correction capabilities are disabled, and the modem functions as a non-error-correcting modem.

Auto-Reliable Mode &E1

In Auto-Reliable mode during the handshaking procedures at the start of the on-line connection, the modem automatically determines whether or not the modem with which it is communicating is using V.42 error correction. If the modem determines that the other modem is using V.42, it switches itself into MNP or LAPM Reliable (V.42) mode and its error-correction capability is enabled. If it is determined that the other modem is not using V.42, the modem remains in Normal mode, without error correction. The default setting is Auto-Reliable mode (*&E1*).

The method the modem uses to determine if the modem it calls is a V.42 modem involves the use of a *"Link Request"*.

When the modem is in Auto-Reliable mode and originates a call, it goes through normal handshaking procedures just like any dial-up modem. After establishing the on-line connection, the modem transmits a Link Request message to the answering modem. (The Link Request message is generally about 33 coded characters.) If the answering modem replies with an appropriate V.42 acknowledgment response, the modem switches into Reliable mode. Otherwise it stays in Normal mode. This V.42 Link Request handshaking procedure generally takes about five seconds.

When operating in V.42 Reliable mode, the modem uses its memory, or buffer, to store data as it is received. During periods of error-caused retransmissions or compression slowdowns, this buffer may fill up. To prevent buffer overflow and subsequent loss of data, the modem uses *"flow control"* to signal the computer attached to its RS-232C port that the modem buffer is close to being full. This causes the computer to pause in its data transmission until the modem is able to empty its buffer sufficiently to accept more data, at which time the modem signals the computer that it may resume transmission.

Reliable Mode &E2

In Reliable mode, the modem uses its V.42 error correction capabilities during all transmissions, and must be connected to another modem with a similar protocol activated (MNP or LAP-M).

V.42 Mode Select #L

The V.42 standard implements both MNP Class 3 & 4 and LAP-M error correction methods. The V.42 Mode Select command *(#L)* selects which type of error correction (MNP or LAP-M) your modem uses for transmissions.

The various *#L* command options are as follows.

#L0 Command	The **#L0** Command allows a pair of modems to negotiate which V.42 mode **(MNP or LAP-M)** will be used in their transmissions.
	Originate Mode
	a. If both modems have LAP-M capability, the modems use LAP-M mode.
	b. If one or both modems do not have LAP-M capability and both have MNP, the modems use the MNP mode.
	Answer Mode
	a. The answering modem responds to either an MNP Link Request or LAP-M Originator Detection Pattern (ODP) signal depending on which the originating modem issues.
#L1 Command	The **#L1** Command sets your modem to MNP error correction and disables LAP-M. This command is for Originate mode only. In Answer mode, the modem still accepts MNP or LAP-M.
#L2 Command	The **#L2** Command sets your modem to LAP-M error correction, and disables MNP. This command is for Originate mode only. Answer mode still accepts MNP or LAP-M.
#L3 Command	In the prior commands, the modems use a two phase process to establish a V.42 connection (detection to establish whether the remote modem is also error correcting, and then protocol establishment to determine parameters and to establish the error correction connection). If you know that the other modem is a V.42 error correcting modem, and you wish to use LAP-M, the **#L3** command disables the detection phase and goes directly to protocol establishment. Both modems must have **#L3** in effect.

Auto-Reliable Buffering $A

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. After this four-second period, the modem drops to Normal mode. Any data which is received during this period is typically discarded. The **$A** command can be used to cause the modem to buffer (save) data that is received during this Auto-Reliable time-out period. This data will then be output by the modem after the *CONNECT* message.

> **AT$A0** = Discard data received during auto-reliable time period.
> **AT$A1** = Buffer data received during auto-reliable time period.

The factory default is **$A0**.

Enable/Disable Auto Reliable Fallback Character $F

In Auto-Reliable mode, the modem is given four seconds to establish a Reliable connection. If a single CARRIAGE RETURN is received from the remote modem during this four second period, the Auto-Reliable modem assumes that the remote modem is not in Reliable mode and drops to Normal (non-error correcting) mode. The CARRIAGE RETURN is the only character which causes the modem to drop to Normal mode. Any other character will either be buffered or discarded.

The **$F** command can be used to disable this fallback-to-Normal-due-to-CARRIAGE-RETURN feature.

The Auto-Reliable fallback character (**$F**) and Auto Reliable buffering (**$A**) commands can be used together to cause the modem to buffer all data received up until the CARRIAGE RETURN, and then drop to Normal mode. All data received will then be output following the *CONNECT* message.

> **AT$F0** = Do not fall back to Normal if CARRIAGE RETURN received.
> **AT$F1** = Fall back to Normal mode if CARRIAGE RETURN received.

The factory default is **$F0**.

Retransmit Count $R

If errors are received during a Reliable connection, the modem re-sends the block of data which contained an error. With the **$R0** command, if another error occurs, the block will be re-sent again. The modem counts the number of times that a data block is re-sent. If the same block of data is resent 12 times and still has not been received properly, the modem assumes that the transmission line is unsuitable for transmission, and abort the connection.

This retransmit counter is disabled by the **$R1** command. When the retransmit counter is disabled, the modem keeps trying to send data and will not abort, no matter how many times the same block is resent.

> **AT$R0** = Disconnect if retransmit count is exceeded.
> **AT$R1** = Do not disconnect due to retransmits.

The factory default setting is **$R0**.

V.42 Error Correction/300bps $E

At 300 bps, error correction is not typically used. **$E1** lets the modem function at 300 bps in either Normal (**&E0**), Auto-Reliable (**&E1**) or Reliable (**&E2**) mode. **$E0**, which is the modem's default, disables 300 bps/V.42 error correction altogether.

> **AT$E0** = No V.42 Error correction at 300 bps.
> **AT$E1** = V.42 Error Correction at 300 bps.

The factory default setting is **$E0**.

4.4.9   Flow Control Commands

Flow control refers to the techniques used by computer devices to stop and restart the flow of data to and from each other. Flow control is necessary so that a device does not receive more data than it can handle. In the case of the MultiModem, there is a need for flow control in both directions. As illustrated on the next page, flow control for data passing from your computer to the modem is called Modem-Initiated Flow Control and flow control for data passing from the modem to your computer is called Computer/Terminal-Initiated Pacing.

The MultiModem supports both hardware and software Modem Initiated Flow Control. On the Computer/Terminal-Initiated Pacing side, it supports hardware and software flow control, and a special version used by Hewlett-Packard compatible systems called ENQ/ACK Pacing. The modem allows hardware and software pacing to be passed through the modem to the other end of the link so that your computer or terminal can control data start/stop activity through your modem.

This is called Xon/Xoff Pass-Through. To state it simply, *"Flow Control"* is something the modem does to the computer, while *"Pacing"* is something the computer does to the modem.

Modem-Initiated Flow Control

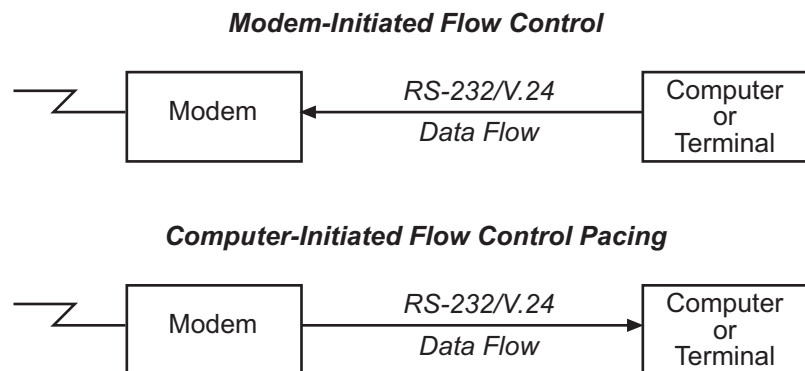*Computer-Initiated Flow Control Pacing*

Figure 4-1. Flow Control and Pacing

Hardware Flow Control &E4

With Hardware Flow Control, the modem uses its RS-232C interface to control the flow of data from the computer or terminal to which it is attached. The CTS (Clear to Send) signal on Pin 5 of the RS-232C interface is brought low to stop the flow of data, and is brought high to restart it. When you select Hardware Flow Control as your Modem Initiated Flow Control method, you will also be selecting it for Pacing.

The difference between the two, however, is that Modem-Initiated Flow Control uses the Pin 5 CTS output signal, while Pacing uses the Pin 4 RTS input signal.

Modem commands are used to select the method of flow control used by the modem when its error correction capabilities are used. If neither method is selected, the modem defaults to no flow control (***&E3***).

Xon/Xoff Flow Control &E5

Xon/Xoff is the most commonly used method of flow control. Under this method, control characters known as *"Xon"* and *"Xoff"* are inserted by the modem into the data to start and stop the flow of data from the computer or terminal to which the modem is attached. Xoff, which is a Control-S, stops the flow of data, and Xon, which is a Control-Q, restarts it. With regard to Binary Data, Xon/Xoff flow control is not recommended because an Xoff character may be part of the data and would trigger an Xoff of the modem or software package, which would halt data flow.

Xon/Xoff Pass-Through &E7

So far, you have had three choices to make regarding pacing:

1. You can set the modem to respond to Xon/Xoff pacing.
2. You can set the modem to respond to RTS pacing.
3. You can set the modem to ignore pacing completely.

Well, we're not done with pacing yet. There's another choice you can make (which actually can apply to both pacing and modem-initiated flow control, although it applies mainly to pacing) and that is something called Xon/Xoff Pass-Through.

This means that if your modem is set to respond to Xon/Xoff commands, you can have the modem do one of the following:

1. The modem responds to the Xon and Xoff pacing commands while at the same time allowing these commands to pass through the modem and on to the remote location. We call this *"Respond, Pass-Through"*.
2. The modem responds to Xon/Xoff pacing, but does not allow the pacing signals to pass through the modem and on to the remote location. We call this *"Respond, No Pass-Through"*.

When Xon and Xoff commands are allowed to pass through the modem, the computer or terminal at the remote site will receive these commands, and depending on how it is configured, the computer or terminal may respond to them also.

When two MultiModems are connected in Normal mode (not using error correction), Xon/Xoff can be used to control the flow of data between the modems. Flow Control can be turned on or off with the Normal Mode Modem Flow Control commands. When the modems are connected in Reliable mode, a different method of modem Flow Control is used, and the commands for Normal Mode Modem Flow Control are ignored.

When you are using Speed Conversion in Normal Mode, you must activate the modem's Normal Mode Modem Flow Control.

Send Xon/Xoff Characters #X

The **#X** phone interface command allows the modem to send either a single or multiple Xoff characters at the modem's buffer full level. When the modem's buffer reaches it's "buffer full" level, the next character received causes another Xoff to be sent for every character subsequently received by the modem.

The **AT#X0** command (factory default setting) causes one Xoff to be sent until the buffer reaches the Xon level. The **AT#X1** command causes an Xoff to be sent for every character received after the modem reaches its buffer full level.

Hewlett-Packard ENQ/ACK Pacing &E9

If the modem is being used with Hewlett Packard (or similar) equipment that employs ENQ/ACK pacing, the modem can be configured to respond to ENQ/ACK commands, making it compatible with HP systems. Doing so does not affect any other flow control or pacing already configured in the modem.

When configured for ENQ/ACK, the ENQ (Control-E) and ACK (Control-F) signals from the HP equipment will be accepted and responded to according to Hewlett-Packard protocol.

Normal Mode Modem Flow Control On &E11

When two MultiModems are connected in Normal mode (not using error correction), Xon/Xoff can be used to control the flow of data between the modems. Flow Control can be turned on or off with the Normal Mode Modem Flow Control commands. When the modems are connected in Reliable mode, a different method of modem flow control is used, and the commands for Normal Mode Modem Flow Control are ignored.

When you are using Speed Conversion in Normal Mode, you must activate the modem's Normal Mode Modem Flow Control.

Terminal/Computer Initiated Pacing &E13

As mentioned earlier, the modem can initiate flow control by issuing Xon/Xoff commands or toggling the CTS signal on the RS-232C interface. The modem can also be configured to react to similar commands and signals from the computer or terminal to which it is attached via the RS-232C interface. We refer to the computer or terminal initiated flow control as Pacing. When the modem is set for Pacing On, the modem will respond to the terminal or computer pacing. When the modem is set for Pacing Off, it will ignore pacing.

In order for the modem to be set for Pacing On, a modem-initiated method of flow control must be previously selected. Once this is done, the modem will respond to either Xon/Xoff commands, or to the toggling of the RTS (Request to Send) signal on Pin 4 of the RS-232C interface, depending on what you selected earlier as your Modem-Initiated Flow Control method.

Maximum Block Size &BS

The maximum size of Reliable mode data blocks can be controlled with the **&BS** command. MNP 3 sends blocks of 1 to 64 characters. MNP 4 and 5 typically send blocks of 1 to 256 characters and LAP-M typically send 128 characters. For MNP Classes 4 and 5/LAP-M, reducing the block size to 64 characters may give a smoother flow of data, and better throughput on noisy phone lines. Using smaller block sizes over good phone lines may cause a slight loss in throughput (*speed*).

> **AT&BS0** = Maximum transmit block size of 64 characters
> **AT&BS1** = Maximum transmit block size of 128 characters (LAP-M) 256 characters (MNP)

The factory default setting is **&BS1**.

Parity Selection #P

The **#P** command enables the setting of parity. **AT#P0** selects no parity. **AT#P1** selects odd parity. **AT#P2** selects even parity and is the default value. Note when setting up your data comm software, it is critical that both your remote and local system's parity selection be set identically.

> **AT#P0** = no parity
> **AT#P1** = odd parity
> **AT#P2** = even parity

The factory default setting is **AT#P2**.

4.4.10   Compression, Error Correction, Flow Control, Pass-Through and Pacing Commands

The modem has a variety of commands to control its error correction and data compression options. These additional commands are listed below. (Remember to precede each command with the AT characters.)

Normal/Auto-Reliable/Reliable Mode Commands:

&E0 =   Normal Mode

&E1 =   Auto-Reliable Mode*

&E2 =   Reliable Mode

Modem-Initiated Flow Control Commands:

&E3 =   Disables flow control (no flow control)

&E4 =   Hardware flow control (CTS on/off and RTS on/off)*

&E5 =   Xon/Xoff flow control

Xon/Xoff Pass-Through Commands:

&E6 =   Modem responds to Xon/Xoff characters, but does not allow Xon/Xoff characters to pass through to remote site.*

&E7 =   Modem responds to Xon/Xoff characters, and allows them to pass through to remote site.

#X0 =   Selects single Xoff character until Xon level returns*

#X1 =   Selects multiple Xoff characters after buffer levels is full.

Enq/Ack Pacing Commands:

&E8 =   Enq/Ack method of pacing off*

&E9 =   Enq/Ack method of pacing on

Normal Mode Modem Flow Control Commands:

&E10 = Normal Mode Modem Flow Control off*

&E11 = Normal Mode Modem Flow Control (Xon/Xoff) on

Computer-or Terminal-Initiated Flow Control (Pacing) Commands:

&E12 = Pacing off*

&E13 = Pacing on (either RTS on/off or Xon/Xoff depending on the setting of &E4 or &E5).*

Data Compression Commands:

&E14 = Data Compression disabled

&E15 = Data Compression enabled*

*Factory Default setting

4.4.11   Speed Conversion Commands

Speed conversion is a necessary part of data compression since data must be presented to the modem faster than it can handle data, if data compression is to be effective.

Speed conversion allows the modem to communicate at one speed over the phone line, and at another speed at the RS-232C interface. The speed (also referred to as *"data rate"* or *"baud rate"*) can be fixed at the RS-232 interface independently of the baud rate of the on-line transmissions.

In addition to data compression, another popular application for speed conversion involves an auto-answer MultiModem connected to a computer that does not have autobaud capability. This means that the computer must be set at a fixed baud rate, regardless of the baud rate that the modem is communicating over the phone line at. In this application, speed conversion allows the modem to match its speed to that of the calling modem, while at the same time communicating with the attached computer through its RS-232C port at a fixed baud rate, which can be pre-selected at 300, 1200, 2400, 4800, 9600, 19,200, 38,400, 57,600 bps or 115,200 bps.

Speed Conversion $BA

When using speed conversion, you must set the modem so that it does not adjust its speed at the RS-232C serial port, even if the modem does adjust its data rate. To turn Speed Conversion ON, enter the command *AT$BA0* and hit RETURN.

To turn Speed Conversion OFF, enter *AT$BA1* and hit RETURN. The modem will now match its RS-232C speed to that of the computer, and will adjust its speed to any changes in the computer's speed in Originate mode, or to the speed of the originating modem in Answer mode. The speed at which the modem communicates over the phone line will always be the same as the speed at which it communicates via its RS-232C serial port.

Modem Baud Rate $MB

The *$MB* command presets the modem's *transmission* baud rate for originate operations, (i.e., the speed of the modem's transmissions over the telephone lines when originating a call). With speed conversion, this transmission speed can be a different baud rate than the serial port speed.

When the modem receives (answers) a call from another modem, it automatically switches its phone line transmission speed to match the calling modem. However, if the modem originates a call to another modem that is unable to connect at the same baud rate, it automatically drops to a lower baud rate in an attempt to match the speed of that modem. For example, if the modem is set for 14,400 baud and calls another modem that has a top speed of 2400 baud, it drops to 2400 baud.

The command to set the Modem Baud Rate is *AT$MBn*, where n can be:

AT$MB75	=	CCITT V.23
AT$MB300	=	300 bps
AT$MB1200	=	1200 bps
AT$MB2400	=	2400 bps
AT$MB4800	=	4800 bps
AT$MB9600	=	9600 bps
AT$MB14400	=	14400 bps
AT$MB19200	=	19200 bps
AT$MB28800	=	28800 bps
AT$MB33600	=	33600 bps

The factory default is 33600 bps.

Serial Port Baud Rate $SB

The **$SB** command presets the speed of the modem's serial (RS-232C) port, in both Originate and Answer modes. Speed conversion allows you to set this serial port baud rate at a fixed speed of up to 115,200 bps for 1932 and 2834 models, and 57600 bps for 1432 models, regardless of the modem's transmission speed setting.

In order for this command to be effective, the modem's Speed Conversion feature must first be turned off with the **$BA** command. When Baud Adjust is on, the modem automatically adjusts its serial port baud rate to match the speed of the computer or terminal it is connected to, as soon as it receives its first AT command. However, in many applications, such as automatic answer, the modem may not receive AT commands, in which case it is very useful to be able to preset the serial port baud rate with this **$SB** command.

In addition to setting the modem's serial port speed, this command also sets the speed at which the modem issues Command mode responses.

The modem will accept AT commands at any speed, regardless of the speed preset by the **$SB** command. If the modem receives such a command at a speed that is different than the preset speed, the modem switches its serial port baud rate to match the new AT command speed, although the baud rate value stored by the **$SB** command remains the same. This provides you with a convenient way to switch the serial port speed, and still make it easy to go back to the original speed automatically the next time the modem is powered up or reset with an **ATZ** command.

The command to set the Serial Port Baud Rate is **AT$SBn**, where n can be:

AT$SB300	=	300 bps
AT$SB1200	=	1200 bps
AT$SB2400	=	2400 bps
AT$SB4800	=	4800 bps
AT$SB9600	=	9600 bps
AT$SB19200	=	19,200 bps
AT$SB38400	=	38,400 bps
AT$SB57600	=	57,600 bps
AT$SB115200	=	115,200 bps

The factory default is for 2834 is 57,600 bps.

Note: Some serial ports, particularly those in older PC-compatible computers, may limit the performance of a higher speed modem like the MultiModem (see Chapter 3). The limiting factor is a circuit called a Universal Asynchronous Receiver/Transmitter, or UART. All data from your modem flows through it. 8250, 16450, and 16550 are UARTs typically used in PC-compatible computers. The 8250 is unreliable above 9,600 bps and the 16450 is unreliable above 19,200 bps. The 16550 UART, however, is reliable to at least 115,200 bps. With V.42bis data compression enabled, the MT2834BA can achieve throughputs approaching 115.2K (depending on line quality and file content). If you presently do not have a 16550 UART in your PC, we recommend that it be replaced with a Multi-Tech high speed Intelligent Serial Interface (ISI) card. It comes in one, two and eight-port versions for DOS/Windows and UNIX systems, and includes a 32 K buffer that eliminates data loss even at high speeds. See your dealer for details.

4.4.12   Immediate Action Commands

Help Screens $H

The Help command is designed to give you short explanations on how to use each modem command. The Help command can be quite useful if your manual is not handy and you are in the middle of a communications session. Although the explanations are quite abbreviated compared to those in this manual, they should prove to be helpful reminders when needed.

At the time of this writing, we have three screens of Help information (Screen #1, #2 and #3), and more screens may be added in the future. The Help commands are structured so that you can call up one of three Help screens, as follows:

> **AT$H1** = Help Screen #1
> **AT$H2** = Help Screen #2
> **AT$H3** = Help Screen #3

Inquiry for Product Code I

Some systems or software packages automatically check the *"identification"* of the modem with which they are communicating, by using the **I** command**.** This *"read"* command lets the software to determine the type of modem with which it is communicating.

When *ATI* or *ATI0* is entered, the modem responds with *247*. When **ATI1** is entered, the modem responds with a three-digit code indicating the firmware version number. When **ATI2** is entered, the modem responds with *MT2834BA, MT1432BA* or *MT932BA* depending on model.

Windows 95 Autodetect Inquiry I9

This read command permits a Windows 95 operating system to query the MT2834BA's characteristics. When *ATI9<CR>* is entered the symbols *BA 28800 FAX CT* are displayed; which indicates to the Windows 95 system that your particular modem is a *MT2834BA, 28,800 bps, fax Class 2* capable modem. With autodetect support in your MT2834BA, your PC can automatically allocate resources and configure it and other devices. The MT2834BA implements autodetect capability in the form of a single *.INF* (Information) file that specifies AT Command mode and Result Code "Registry Keys" that are specific to your MT2834BA.

Listing Current Operating Parameters L5 L7

The *L5* and *L7* commands list the current operating parameters of your modem. This information can be very useful when you are changing communications software or when you are changing modem default settings.

The command to list the modem's current operating parameters is *ATL5* for the basic parameters. Entering *ATL7* lists additional parameters on the modem.

Listing S-Register Values L6

Entering *ATL6* lists the current values stored in the modem's S-Register. This information can be very useful if you wish to change S-Register values.

Listing On-Line Diagnostics L8

The *L8* command displays the current on-line *CONNECT* status of the modem. This display can be printed and used as a modem status report or as diagnostic information (such as when calling Tech Support). To activate this command first type *+++AT<CR>*(*on-line escape command while maintaining command mode*), then type *ATL8*. What then displays on your monitor is your modem's current on-line condition (e.g., Link Type, Line Speed, Serial Speed, Type of Error Correction/Data Compression, Number of past Retrains, etc.).

Off Hook H

You can make the modem hang up (go On Hook). Entering **ATH1**<RETURN> brings the line Off Hook, just as if you picked up the telephone set. You can hang up by entering **ATH0 or ATH** (the default is 0 when no number is entered).

Escape Sequences- Entering Command Mode While Still On-Line +++AT<CR>

It is possible to cause the modem to enter Command mode after the modem has gone on-line with a remote modem, without disconnecting the call. This is done by entering an Escape Code. The default Escape Code used by the modem is three plus signs (**+++**) followed by the letters **A** and **T**, up to sixty command characters (most typically **"H"**, to hang up), and a RETURN. The number of command characters allowed after +++ AT<CR> , is defined by S-Register S34. S-Register S34 defaults to ten command characters.

When this is done, the modem escapes to Command Mode, executes the command (if any), and then remain in Command mode. For example, to hang up the modem at the end of a call, enter **+++ATH** and hit RETURN. There is no need to incorporate pauses before and after the plus signs, as done in earlier modems.

BREAK AT<CR>

The modem provides an alternative Escape method, using a Break signal as the Escape Code. The Break signal allows the start-stop DTE (data terminal equipment) to signal the modem without loss of character transparency. With this method, a **BREAK** signal is used instead of the three plus signs. The **BREAK** is followed by the letters **A** and **T**, up to 60 command characters, and **RETURN**. When this is done, the modem executes that command, but remains in On-Line mode unless the command was to hang up and/or reset the modem (an **H** or **Z**), in which case the modem would be in the Command Mode after executing that command.

Escape Sequence Options - Entering Command Mode While On-Line %E

As mentioned, the default escape sequence setting is for the modem to respond to the **+++** escape method. Optional settings are for the modem to respond to the Break method, for the modem to respond to either the **+++** or the Break Methods, for the modem to ignore both methods and not escape, for the modem to respond with no *"OK"* to **+++**, and for the modem to respond with *"OK"* to **+++**. The **%E** command is used to select these options, as follows:

%E0	=	Modem Won't Escape
%E1	=	+++ AT<CR> Method **(default)**
%E2	=	Break Method
%E3	=	Either +++ or Break Methods
%E4*	=	No "OK" Response to +++
%E5*	=	"OK" Response to +++

* The **%E4** and **%E5** commands enable or disable an *"OK"* response, which is required by some software packages during an escape sequence.

Force Answer Mode A

You can force the modem into Answer mode with the modem's **A** command.

Entering **ATA** when in Command mode immediately brings your modem off-hook, out of Command mode and into On-Line Answer mode, and causes it to transmit its carrier signal over the phone line. If no responding carrier tone is received by your modem within forty-five seconds (or some other time as determined by S-Register S7), your modem stops transmitting its tone, hangs up, and goes back into Command mode.

Exiting Command Mode, Going Back On-Line O

You can bring the modem out of Command mode and back into On-Line mode by entering **ATO** (where O is the letter O, not the number 0). In this case, the **O** command reverses what was done by entering the Escape Code. The **O** command will bring the modem into the same On-Line mode (Originate or Answer) that it was in prior to going into Command mode.

4.4.13   Line Probe Commands

Before V.34 negotiation takes place, remote and local modems transfer their functional capabilities using modulated calling and answering tones; indicating the common capabilities of the modem at each end.

Once this is done, a probing signal is passed between the modems to identify impairments in the telephone channel (e.g., Receive Signal Strength vs. Frequency, Noise vs. Frequency and Signal to Noise Ratio vs. Frequency). After receiving the results of the probing signal, the modem receivers and transmitters begin with the lowest speed and move up until reaching the highest speed at which they can exchange data. All this occurs in about five seconds.

There are a number of Line Probe Commands. These commands are configurable and can be stored to RAM (via **AT&W0**).

These commands are listed below.

Enable/Disable Reading of Line Probe Information Commands:

%DP0 = Do not read Line Probe information from DSP during handshake (Default).

%DP1 = Read Line Probe information from DSP during handshake.

Format of Line Probe (*Graph or Table*) Commands:

%DF0 = Data is displayed in Graph format. Y axis is shown in dBms (Default).

%DF1 = Data is displayed in Table format. Numeric values are displayed for 150Hz to 3750Hz in 75HZ increments.

Immediate Action Line Probe Commands:

To activate these commands first type **+++AT<CR>**(*on-line escape command while maintaining command mode*), then type the Command prefixed by an *AT.*

&RP = This command initiates a retrain that makes the processor read Line Probe information. Valid only when on-line in V.34 mode.

L9 = Displays Signal Strength information.

L10 = Displays Signal to Noise Ratio information (*SNR*).

L11 = Displays noise information.

MultiModem II

Chapter 5 - S-Registers

MultiTech Systems

5.1   Introduction

Certain Command Mode configurations are stored in memory registers called, S-Registers. The **S** command is used to assign a value to, and to read the current value of an S-Register. To assign a value to an S-Register, enter the letter **S**, followed by the S-Register number and an equals sign (=), and then a decimal response to the message *"ENTER THE NEW VALUE IN DECIMAL FORMAT"*. To read an S-Register value, enter the letter **S** followed by the S-Register number and a question mark (*?*), then hit RETURN. To verify that the S-Register value was entered correctly, enter for example, **ATS8?** and hit RETURN. You should receive a response of the assigned value given to that S-Register.

S0
Number of Rings Until Modem Answers

Unit: 1 ring
Range: 0-255
Default: 1
Description: S0 defines the number of rings the modem waits before answering an incoming call. The default value is one ring (Decimal 1), which means that the modem answers the call immediately after the first ring. The maximum number of rings that can be configured is 255. Setting the value to zero (0) disables auto-answer completely.

S1
Rings Which Have Occurred

Unit: 1 ring
Range: 0-255
Default: 0
Description: S1 counts the number of rings that have occurred. It is a *"read"* type of register and is seldom, if ever, used in typical operation. Each time an incoming ring signal is detected, S1 increases its value by one, up to a maximum of 255. If you set S1 to a value other than its default value of zero, or if the value is increasing with rings, this new value remains stored in S1 for eight seconds after the last ring is counted, after which time the value reverts to zero.

S2
Escape Code Character

Unit: ASCII Character
Range: 0-127
Default: 43 (+)
Description: S2 defines the escape code character. The default character is the plus (+) sign (Decimal 43), but may be set for any ASCII character. Setting an S2 value greater than 127 results in no escape character, and therefore no means of entering Command mode from On-line mode without breaking the on-line connection.

S3
Return Character

Unit: ASCII Character
Range: 0-127
Default: 13 (^M)
Description: S3 defines the character recognized as Carriage Return (RETURN) or "Enter". S3 may be set for any ASCII character.

S4
Line Feed Character

Unit: ASCII Character
Range: 0-127
Default: 10 (^J)
Description: S4 defines the character recognized as Line Feed. S3 may be set for any ASCII character.

S5
Backspace Character

Unit: ASCII Character
Range: 0-127
Default: 8 (^H)
Description: S5 defines the character recognized as BACKSPACE. S5 may be set for any ASCII character.

S6
Wait Time for Dial Tone

Unit: 1 second
Range: 2-255, 4-255**
Default: 2, 4**
Description: S6 sets the time the modem waits after the RETURN key is pressed before executing a dial command. The default setting is two seconds (Decimal 2).

S7
Time for Carrier (Abort Timer)

Unit: 1 second
Range: 1-255, 1-45*
Default: 45
Description: S7 defines the Abort Timer (lack of carrier) delay time. The default value is 45 seconds (Decimal 45). This means that, after dialing, the modem waits for a carrier signal for up to 45 seconds and, if none is detected, aborts the call. The maximum S7 value is 255.

S8
Pause Time for Comma

Unit: 1 second
Range: 0-255, 4-255**
Default: 2, 4**
Description: S8 sets the length of the pause caused by a comma inserted in a dialing command. The default setting is two seconds, (or two units Decimal 2) or four seconds, where each unit is one second. S8 may be set for up to 255 seconds.

S8 also sets the time the modem waits before retrying a call after detecting a busy signal. Some computer systems need more than two seconds to reset (in which case you should increase the value of S8).

* Value for International and DOC units
** Value for International units only

S9
Carrier Detect Response Time

Unit: 100 mSec.
Range: 1-255
Default: 6
Description: S9 sets the time delay between when the modem first detects a valid incoming carrier signal and when the modem turns on its Carrier Detect circuit. The default setting is 600 milliseconds, or six units of 100 mSec each (Decimal 6). S9 may be set for up to 25.5 seconds.

S10
Carrier Loss Disconnect Delay Time

Unit: 100 mSec.
Range: 0-255
Default: 7
Description: S10 sets the time a carrier signal must be lost before the modem disconnects. The default setting is 700 mSec, or seven units (Decimal 7) of 100 mSec. Maximum delay is 25.4 seconds (Decimal 254). Setting the S10 value to 255 causes the modem to not disconnect with loss of carrier. (This S-Register applies at speeds of 2400 bps and less.)

S11
Tone Dialing: Tone Spacing and Duration

Unit: 1 mSec.
Range: 1-255, 80-255*
Default: 70, 80*
Description: S11 sets the speed of tone dialing (spacing and tone duration times). The default value is 70 units (Decimal 7) or 80 units, where each unit is one mSec, meaning that each tone is on for 70 mSec with a 70 mSec pause between each.

                  The minimum S11 value allowed by most telephone systems is 50 mSec (50 units). Very few telephone systems can handle anything faster than that. The maximum S11 value is 255 mSec (255 units).

S13
Remote Configuration Escape Character

Unit: ASCII Character
Range: 0-127
Default: 37 (%)
Description: S13 defines the remote configuration escape character (which becomes your modem's remote configuration character). The default is three percent symbols (%%%). When the S13 character is entered three consecutive times from a remotely connected site, your modem responds with its Remote Configuration procedure.

* Value for International and DOC units
** Value for International units only

S15
Callback Time Delay

Unit: Seconds
Range: 10-255
Default: 20
Description: S15 defines the time delay between Callback attempts after initial passwords have
                    been exchanged between modems.

S16
Callback Attempts

Unit: 1 Attempt
Range: 1-255
Default: 4
Description: S16 defines the number of attempts allowed after initial passwords have been
                    exchanged between modems.

S17
Changing Break Time

Unit: 10 mSec.
Range: 0-2.5 sec
Default: 250
Description: S17 defines the break time (*space*) sent to the local PC. The default is set for a 25 to
                    250 mSec break. The break time can be changed in 10 mSec increments by
                    increasing or decreasing the value of S17.

S24
PBX/CBX Disconnect Drop Time for DSR/CTS/CD

Unit: 50 mSec.
Range: 0-255
Default: 20
Description: Some PBX and CBX phone systems require the modem's DSR, CTS, and/or CD
                    signal(s) to behave in a certain manner when calls are disconnected. The modem's
                    &R, **&S,** and **&C** commands cause the modem to drop these signal(s) for a specified
                    time period upon disconnect, and then bring the signal(s) up again. S24 defines the
                    length of time that the signals drop. The default setting of 20 results in a one second
                    drop time, which is what most PBX/CBX systems with this requirement need.

S25
DTR Dropout Time

Unit: 100 mSec.
Range: 0, 1 through 255
Default: 0
Description: S25 defines the amount of time that DTR must be dropped before the modem
                    disconnects. Typically, a disconnect occurs when DTR is dropped for 50
                    milliseconds or more. This dropout time can be increased, up to a maximum of 25.5
                    seconds. The S25 unit value for zero is the default value of 50 mSec. For values
                    from 1 through 255, the unit value is 100 mSec.

S26
Failed Password Attempts

Unit: 1 failed attempt
Range: 0-255
Default: 0
Description: S26 counts the number of times there has been a failed password attempt. For example, if you entered **ATS26?** the message *003* would be displayed, meaning someone has failed three times to gain access to your modem using its password security system.

S29
Local Inactivity Timer

Unit: minutes
Range: 1-255
Default: 20
Description: S29 defines the amount of idle time that can elapse between AT commands after the SETUP password has been entered. If this timer expires, the LOGIN and SETUP passwords will have to be re-entered. S29 only takes effect when the modem has been sent a **#DB1** command, which secures the modem from local and remote configuration or dialing (i.e., no AT commands can be sent until the LOGIN and SETUP passwords have been entered).

S30
Inactivity Timer

Unit: 1 min.
Range: 0-255
Default: 0
Description: S30 causes the modem to disconnect if no data is transmitted or received for a specified time. This timer runs during both Reliable and Normal error correction connections. The timer restarts any time a data character is passed through the serial port (either sent or received). If noise on the phone line causes an error to be received during Normal mode, this also restarts the timer. The default value is off (0).

                  The inactivity timer is disabled by setting S30 to 0, which is the factory default setting.

S32
Time Elapse for Escape Sequence

Unit: 1 second
Range: 0-255
Default: 20
Description: S32 sets the time period to validate the escape sequence. If the time interval expires before the escape sequence is employed (by hitting RETURN), the escape sequence is aborted. The default is 20 units.

S34
Buffer Length of Command Mode...After On-line Escape Sequence

Unit: ASCII Character
Range: 0-60
Default: 10
Description: If the number of characters after AT exceeds the S34 buffer length value, the buffer is cleared and the escape sequence is aborted.

S36
Time Between DTR Inactive and Modem Off-Hook

Unit: 1 Second
Range: 0-255 seconds
Default: 0
Description: The DTR Busy-out feature uses S-Register S36 to set the time between DTR inactive (low) and the modem going *off-hook*. S36 can be set in one-second intervals from 0 to 255 seconds. With the default setting of S36=0, DTR Busy-Out is disabled (i.e., DTR won't Busy-Out).

S37
Time Between DTR Active and Modem On-Hook

Unit: 1 Second
Range: 0-255 seconds
Default: 5
Description: S37 sets the time between DTR being active and the modem going *on-hook* (not busy). S37 will only function in conjunction with S36.

S48
Program V.34bis Connect Speeds *(2834 Series only)*

Unit: N/A
Range: 33, 31, 28, 26, 24, 21,19,16,14,12, 96 and 48
Default: 0
Description: Defines which speed modem connects within the scope of Enhanced V.34 mode (e.g., S48 = 26 means maximum connect speed is 26.4K). This register compensates for line conditions that have trouble supporting higher Enhanced V.34 speeds (e.g., 33.6K, 31.2K, 28.8K, 26.4K, 24K...). The modem default is a value of 0, which indicates a connection attempt of 33.6K.

5.2   Reading and Assigning S-Register Values

The **S** command is used to assign a value to, and to read the current value of, an S-Register. To read an S-Register value, enter the letter **S** followed by the S-register number and a question mark (*?*), then hit RETURN. For example, entering **ATS7?** and hitting RETURN displays the value of S-Register S7 in a 3-digit decimal form. The number 8 would appear as *008*, the number 30 would appear as *030*, and the number 255 would appear as *255*.

To assign a value to an S-Register, enter the letter **S** followed by the S-Register number and an equals sign (=), and then a decimal response to the message *"ENTER THE NEW VALUE IN DECIMAL FORMAT".* Convert all ASCII characters to their decimal equivalents before entering them. S-Register decimal values range from 0-127 for ASCII characters, or 0-255 for numeric values.

5.2.1   Examples of Assigning Values

1. Let's say you wish to have longer pauses caused by the comma in a dial command; five seconds instead of two. Entering **ATS8=5** assigns 5 as the value for S-Register S8 (meaning the modem pauses five seconds for a comma in a dial command).

2. In a second example, let's say that you wish to configure the modem to answer incoming calls after the 30th ring instead of after the first ring. To configure S-Register S0 with a value of 30, enter **ATS0=30** and hit RETURN.

3. In a third example, let's say you are calling long distance to another country code, and it is taking a long time to connect. The S-Register S7 (Abort Timer) setting of 45 seconds, is insufficient. The abort timer times out and cancels the call before a connection is made. To change the S7 value to 55 seconds, enter Command mode, then enter **ATS7=55** and hit RETURN. Now, after dialing, the modem allows 10 more seconds for a carrier signal before aborting the call. The additional 10 seconds should provide enough time for international calls.

5.2.2   Examples of Reading Values

To verify that you entered the value correctly in the above examples, enter **ATS8?** and hit RETURN in the first example, **ATS0?** in the second, and **ATS2?** in the third example. You should receive the response *005* in the first example, *030* in the second example, and *055* in the third example.

When configuring the S-Registers, it is a good practice to include the verification read-entry in the same command line as the configuration assignment-entry. In the three preceding examples, enter **ATS8=5S8?, ATS0=30S3?,** and **ATS7=55S7?**.

5.3   AT Command and S-Register Summary

The vast majority of installations are similar, with the modem being used to dial up a remote installation where the call is automatically answered. Your modem has a default configuration to dial another modem that supports error correction, data compression and flow control. If the answering modem is not compatible, the MultiModem can match protocols, provided the protocols are industry standard (i.e., ITU or Bell) and not proprietary.

The **&W** command, used in conjunction with specific other AT commands and S-Registers, can re-configure the modem to conform to a specific application. The command **AT&W0** (or **AT&W**) causes the modem to store its current parameters in its nonvolatile RAM. The command also sets the modem upon power up, or when it is reset with an **ATZ** command, the modem reads all of its configuration and S-Register parameters from RAM, and not from the factory settings in ROM (note you may recall factory installed defaults by entering **AT&F8&W0**). The **&W** command changes the configuration parameters stored in RAM that you specifically intend to alter. All other default parameters remain unchanged.

The **AT&W1** command sets the modem so that it does not store its parameters in RAM, and on power up or when an **ATZ** command is issued, parameters are read from the factory default settings in ROM.

Before using the **&W** command, you may want to view the modem's current operating parameters. Use the **ATL5**, **ATL6** and **ATL7** commands to display the current modem configuration.

MultiModem^{II}

Chapter 6 - Callback Security and
Remote Configuration

MultiTech® ○
Systems

6.1   Introduction

This chapter describes how the MultiModem's Callback and Remote Configuration features operate. These features use a multilevel security system, which involves the use of LOGIN Passwords, Setup Passwords and Remote Escape Characters.

The primary level security code is the modem's LOGIN Password. Once this password is entered, other passwords can be used. For instance, entering the LOGIN Password will allow you to enter the Setup Password, which, in turn, allows you to enter Callback Passwords and dial back phone numbers. Callback Passwords tell your modem what dial back phone number to call.

The Remote Escape Character is the key to using the Remote Configuration feature. The Remote Escape Character lets you enter Command mode via a remote call, so that you can enter AT commands just as if you were locally connected. You must also enter your modem's Setup Password. The Remote Escape Character is contained in S-Register S13.

6.2   Callback Feature Description

The Callback feature protects your network from unauthorized access and helps control long distance costs. By use of Callback Passwords and dial back phone numbers, you can have your modem "dial back" remote locations immediately after being called. A special command (Enable Callback **#DB**) turns your modem into a Callback security modem. The Callback Password/Phone number entry is protected by two-level security (your modem's LOGIN Password and Set-Up Password) that keeps unauthorized personnel from changing parameters. When you first get your modem, you need to change both security level codes to your unique settings.

The Callback Passwords and dial back phone numbers are in a special Callback Password/dial back phone number memory (30 numbers long). You use the modem's LOGIN Password and the Set-Up Password plus special Callback commands to access this memory. The memory is thirty numbers long and replaces your modem's normal phone number memory.

Each number is 35 characters long and can contain commands as well as phone numbers. You need to set up your modem with the numbers and codes as part of the dial back initialization procedures. Your modem will also remember if the incoming call was reliable or not, and make the call back accordingly.

6.3   Remote Configuration Description

The Remote Configuration feature is a network management tool that allows you to configure modems remotely. This means you could configure modems anywhere in your network from one location without having to visit the sites or rely on remote users to follow your instructions. With Remote Configuration, which is protected by two level security, you can download new parameters, program new V.42 capabilities and implement new features. Remote Configuration also makes troubleshooting a remote location a lot easier.

The way Remote Configuration works is that S-Register S13 has been set up to contain the special Remote Configuration escape code. When calling a Remote Configuration equipped modem, you enter the proper Remote Escape code to enable entering your Set up Password. After entering it, you can then execute AT commands as if you were connected locally. If you set S-Register S13 to zero, Remote Configuration is disabled.

6.3.1   Initial Setup Procedures for Callback and Remote Configuration.

Your modem was shipped with a default LOGIN Password and Setup Password (LOGIN=MULTI-TECH and Set-up=MODEMSETUP) so that you have access to the features used for configuring the modem. Because the defaults are in the modem owner's manual, and anyone can find out what they are, you should change the codes as the first step of your initialization procedure.

Table 6-1. Modem LOGIN, Setup and Remote Escape Code Procedures

To change your modem's LOGIN Password and Setup Password:

Step   Procedure

Note: Passwords are upper/lower case sensitive. The case you enter here is the case that must be used at Log-In.

1. Type **AT#IMULTI-TECH** and hit RETURN. Your modem will respond with:

    OK (if the LOGIN Password is wrong, the modem's response is *ERROR*)

2. Type **AT#SMODEMSETUP** and hit RETURN. Your modem will respond with the following:

    OK (or *ERROR* if wrong Setup Password)

    Note: At this point you can change the LOGIN Password and Setup Password.

3. Type **AT#I=xxxxxxxxxx** (with any keyboard characters used, minimum 6 maximum 10) and hit RETURN. Your modem responds with:

    OK

4. Type **AT#S=yyyyyyyyyy** (with keyboard characters used, minimum 6 maximum 10) and hit RETURN. Your modem responds with:

    OK

To change your Remote Configuration feature status:

5. If you want Remote Configuration off, set S-Register S13 to 0 (zero). Refer to Chapter 6 for details on how to set S-Register values.

6. If you want Remote Configuration on and wish to change the Remote Escape Character, change the S-Register S13 value. If you leave it at the default value, decimal 37 (% sign) will be your modem's remote escape character.

To turn your modem's Callback Security feature on and off:

7. If you want Callback Security with both remote and local password security, enter **AT#DB1** and hit RETURN. You must turn on Callback Security to be able to enter dial back phone numbers.

8. If you want Callback Security on with just remote password security, enter **AT#DB2** and hit RETURN. You must turn on Callback Security to be able to enter dial back phone numbers. If you want to use your modem to call another modem that is also set for Callback, you must enter **AT#DB3** before you dial.

    Note: this is for your modem if you are set for #DB1 or #DB2.

    Once you have disconnected from that call, your modem will go back to its original setting.

9. If you want Callback Security turned off, type **AT#DB0** and hit RETURN.

To set parity of the password/message prompt:

10. The parity default value for your modem is no parity (**AT#P0**). If your modem's prompt messages use even parity, enter **AT#P2** and hit RETURN. For odd parity, enter **AT#P1** and hit RETURN.

11. Enter the **&W0** command and hit RETURN to store parameters and S-Register values in RAM.

Table 6-2. Callback Password and Dial Back Phone Number Entry Procedures

<u>Step</u>   <u>Procedure</u>

1. Enter your modem's LOGIN Password (as selected in Table 6-1) by entering the following:

   AT#Ixxxxxxxxxx<CR> (xxxxxxxxxx from Table 6-1)

   Enter your modem's Setup Password (as selected in Table 6-1) by entering the following:

   AT#Syyyyyyyyyy<CR> (yyyyyyyyyy from Table 6-1)

2. Enable the Callback Security feature by entering the following:

   AT#DB2<CR>   or   **AT#DB1<CR>**

   The following message is displayed on your monitor:

   Entering Callback Mode, current phone numbers will be erased. Do you want to continue? (Y/N)

3. Enter a *Y* or *N* and hit RETURN.

   Note: If this is your first time into Callback Mode, we recommend answering Y to clear all previous Callback Passwords and phone numbers from memory.

4. Enter individual Callback Passwords for each of 30 different phone number memory locations as follows:

   AT#CBN0xxxxxxxxxx<CR>

   To enter Callback Password for the first location (a minimum 6 characters, up to a maximum of 10 characters must be used).

   AT#CBN1xxxxxxxxxx<CR>

   To enter Callback Password for the second location...etc (a minimum 6 characters, up to a maximum of 10 characters must be used).

   Note: The first character of your first Callback Password must be non-numeric.

5. Enter individual phone numbers for each of the 30 memory locations as follows:

   AT+ - DP...????N0 <CR> (number for location N0)

   AT+ - DT...????N1 <CR> (number for location N1)...etc

   Note: You must indicate within the command string that the modem either Pulse dial (**ATDP**...) or Tone dial **ATDT**...).

   The maximum length of the number is 35 characters. The number may include commands as well as your number, so as to create macro-type command numbers.

   The + and/or - characters entered before the phone number are optional. The + (Deposit Number) code allows a caller to enter the number he or she wishes the Callback modem to call back when the caller uses a particular password (Step 3 of Table 6-3). The - character enables direct entry when the caller uses that correct password (Step 3 of Table 6-3) without the Callback modem having to return the call.

   The ??? entry at the end of the phone number is optional and indicates a subcode number to the main phone number for that location. The ??? used to dial different extensions at the same basic number. To use this optional feature, enter the number of ? marks where indicated equal to the number of digits in the desired extension number, (i.e., with a 4 digit extension enter ????). When a caller uses that particular password (Step 3 of Table 6-3), he or she then enters an extension number directly after the password, with the same number of digits as the number of ? marks originally entered. When calling back that particular number, your modem will also dial the indicated extension number.

   Note: To view Callback Passwords/Numbers, use the *L* Command.

6. To store changed parameters to memory, enter **AT&W0** and hit RETURN.

   Note: If you have enabled Callback Security (**#DB1** in step 2 of Table 6-2), the modem will be secured locally. To gain local access, you must again perform steps 7 and 8.

7. Enter your modem's LOGIN Password (as selected in Table 6-1) by entering:

   AT#Ixxxxxxxxxx<CR> (xxxxxxxxxx from Table 6-1)

8. Enter your modem's Setup Password (as selected in Table 6-1) by entering:

   AT#Syyyyyyyyyy<CR> (yyyyyyyyyy from Table 6-1)

Table 6-3. Callback Operational Sequence Procedures

Perform the following steps when dialing into a dialback modem:

Step   Procedure

1. When called, the modem answers and after a slight delay, responds with:

   Password>

2. Enter your modem's LOGIN Password (Table 6-1) and hit RETURN. If entered correctly, the modem responds with:

   DB>

3. Enter the Callback Password corresponding to the phone number you wish called back and hit RETURN (Callback Passwords and phone numbers entered in Table 6-2). You can also use special characters + and -. They must have been entered as part of the Callback phone numbers in Step 5 of Table 6-2. If you use the - character along with your password, the Callback modem will connect directly without hanging-up and calling back. If you use the + character along with your password, you can also enter a phone number which you wish the Callback modem to dial after hanging-up. The + and - characters must be entered after the Dial-back password, (i.e., **DB>xxxxxx+**). This is also the point where you enter an extension number if your Callback number used the ??? feature (Step 5 in Table 6-2).

   You have three tries at each prompt to enter the information properly, with an incorrect entry resulting in a password retry. You must enter the requested information correctly within one minute or the Callback modem will hang-up. When the information is entered properly, the called modem will hang-up and after a 15 second delay, call you back. When your modem answers, the dialback modem will respond with the following:

   Password>

4. Enter the modem's LOGIN Password again (the same as in Step 1). The Callback modem responds with:

   CONNECT

You are now in Data Mode.

6.3.2   Remote Configuration Procedures

The procedures for using the Remote Configuration features are the same whether or not a call originates from the remote modem. Once the modem is on-line, perform the procedures in Table 6-4.

Table 6-4 Remote Configuration Operation Procedures

Step   Procedure

1. Remote Escape Configuration requires %%%AT<CR> to be sent if the default value in S-Register S13 has not been changed.

   The modem responds with:

   1. - DATA Mode
   2. - COMMAND Mode

2. You then select 1 or 2. With 1, the modem goes back into data mode and with 2, the modem responds with the following:

    Password>

3. Enter your Setup Password, and if the code is correct the modem responds with:

    OK

    You can now use any AT commands of the modem being remotely configured as if they were being entered locally. You cannot change the setup of the LOGIN Password until you enter the proper LOGIN Password.

4. When you are done entering AT commands and you want to exit, type **AT0** and hit RETURN. The modem responds with:

    1. DATA Mode
    2. COMMAND Mode

5. Enter a 1 to go back on-line with your computer, or enter 2 and the correct password to talk to your modem.

6.4   Remote Configuration and Callback Security AT Commands

When you have callback security enabled for the modem, anyone trying to connect with the modem will be required to furnish a password. The **#CBN** command allows you to enter passwords for each of the 30 memory locations used for callback security. The length of each password can be up to 10 characters, but must be at least 6 characters. Any ASCII character can be used.

The format for this command is **AT#CBNyyxxxxxxxx**<CR> with **xxxxxxxx** representing the password and **yy** being the memory location (0-29). Each callback password (**xxxxxxxx**) must start with a non-numeric character.

Callback Security Enable/Disable   #DB

The purpose of this command is to enable or disable (default setting) your modem's callback security option. Once this command is executed, you modem will undergo some significant changes. For example, the phone number memory locations (N0 through N9) will be used for passwords and phone numbers. In other words, you will not be able to dial from memory or use the DTR dialing feature.

You can turn on callback security by typing **AT#DB1** or **AT#DB2** and pressing <CR>. If you want to engage both remote and local password security, use the **#DB1** command. This sets up the modem so you have to provide passwords to dial into the modem and to dial out. For remote password security only, use the **#DB2** command. This allows the local operator to dial out without providing the LOGIN and SETUP passwords. Use **#DB3** when calling another modem with callback security active.

Change LOGIN Password   #I

The default LOGIN password for your modem is *"MULTI-TECH"*. If you choose to activate callback security, you should change the LOGIN password using this command in the following format:

AT#Ixxxxxxxxxx<CR> (where *xxxxxxxxxxxxxxxx* is the current LOGIN password). Your modem will respond with *"OK"*, indicating that you can enter the new LOGIN password as follows:

    AT#I=yyyyyyyyyy<CR>

You can select any combination of keyboard characters (upper/lower case sensitive) between six and ten characters long.

Change SETUP Password   #S

The default SETUP password for your modem is *"SMODEMSETUP"*. If you choose to activate callback security, you should change the SETUP password using this command in the following format:

AT#Sttttttttttt<CR> (where *tttttttttt* is the current SETUP password). Your modem will respond with *"OK"*, indicating that you can enter the new SETUP password as follows:

   AT#s=uuuuuuuuuu<CR>

You can select any combination of keyboard characters (upper/lower case sensitive) between six and ten characters long.

Erase Callback Password   #RCBNxx

This command erases the single callback password specified by *xx* (0 through 29).

Erase Callback Phone Number #RDNxx

This command erases the single phone number specified by *xx* (0 through 29).

6.5   Remote Configuration/Callback Security S-Registers

The following S-Registers are used with Remote Configuration and Callback Security features.

Remote Configuration Character (S13)

S13 defines the modem's remote configuration escape character. When the S13 character is entered three consecutive times from a remotely connected site, your modem responds to it with its Remote Configuration procedure.

Units: ASCII
Range: 0-127
Default: 37 (*% sign*)

Callback Time Delay (S15)

S15 defines the time delay for Callback attempts after initial passwords have been exchanged between modems.

Unit: Seconds
Range: 10-255
Default: 20

Callback Attempts (S16)

S16 defines the number of Callback attempts after initial passwords have been exchanged between modems.

Unit: 1 Attempt
Range: 1-255
Default: 4

Failed Password Attempts (S26)

S26 counts the number of times there has been a failed password attempt. For example, if you entered **ATS26?** the message *003* would be displayed, meaning someone has failed three times to gain access to your modem using its password security system.

Units: 1 failed attempt
Range: 0-255
Default: 0

Local Inactivity Timer (S29)

S29 defines the amount of idle time that can elapse between AT commands after the SETUP password has been entered. If this timer expires, the LOGIN and SETUP passwords will have to be re-entered.

S29 only takes effect when the modem has been sent a ***#DB1*** command, which secures the modem from local and remote configuration or dialing (i.e., no AT commands can be sent until the LOGIN and SETUP passwords have been entered).

Units: Minutes
Range: 1-255
Default: 20

MultiModem II

Chapter 7 - DIP-Switch Settings

MultiTech Systems

7.1 Introduction

There are several DIP-Switch options on the modem's printed circuit (PC) board. The DIP-Switches are accessible through a cut-out on the side of the modem. This chapter explains the modem's printed-circuit board options. Sixteen DIP-Switch settings and the modem's speaker volume control are explained in detail, including all default settings.
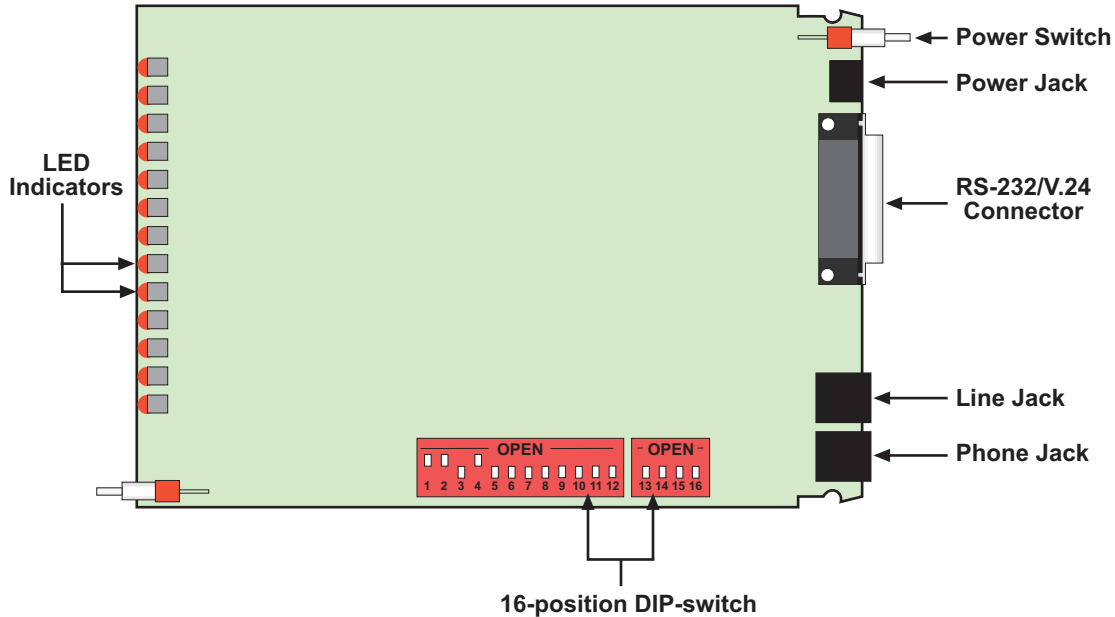
Figure 7-1. PC Board

7.2 DIP-Switch Option Settings

Switch #1
Forced DTR -- "DTR"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The modem must have a high DTR signal in order to operate. DTR is provided to the modem by the terminal or computer to which it is attached, through pin 20 of the RS-232C/V.24 interface. If your terminal or computer is not providing DTR to the modem, you can force the DTR signal high with DIP-Switch #1.

DTR function normally	=	Switch #1 UP
DTR forced On	=	Switch #1 DOWN
Factory Default Setting	=	UP

Switch #2
Flow Control - &E4/&E5
(Asynchronous Mode/Leased Line/Dial-Up)

With Hardware Flow Control, the modem uses its RS-232C/V.24 interface to control the flow of data from the computer or terminal to which it is attached. The CTS signal on Pin 5 of the RS-232C/V.24 is brought low to stop the flow of data, and is brought high to restart it. Place DIP-Switch #2 in the UP position to enable Hardware Flow Control (*&E4*). Xon/Xoff Flow Control (*&E5*) is another flow control method. Xon/Xoff characters in the data dictate the start and stop of data flow from the computer or terminal. Place DIP-Switch #2 in the DOWN position to select Xon/Xoff Flow Control.

Hardware Flow Control (*&E4*)	=	Switch #2 UP
Xon/Xoff Flow Control (*&E5*)	=	Switch #2 DOWN
Factory Default Setting	=	UP

Switch #2
SDLC/BSC Option
(Synchronous Mode/Leased Line/Dial-Up)

Synchronous Data Link Control (*SDLC*) and Binary Synchronous Control (*BSC*) are two error correction protocols used in the IBM Mainframe environment. Place DIP-Switch #2 in the UP position to enable SDLC mode, and place DIP-Switch #2 in the DOWN position to enable BSC mode.

SDLC Mode	=	Switch #2 UP
BSC Mode	=	Switch #2 DOWN
Factory Default Setting	=	UP

Switch #3
Enable/Suppress Responses -- "Q"
(Asynchronous Mode/Dial-Up)

In some Asynchronous mode applications, you may want to suppress all responses from the modem. Place DIP-Switch #3 in the DOWN position to enable Result Code responses (*Q0*). Place DIP-Switch #3 in the UP position, and answer mode is handled without responses and echo turned off (*Q2*), but originate is still intelligent.

Enable Responses: Originate/Answer (*Q0*)	=	Switch #3 DOWN
Suppress Responses: Answer (*Q2*)	=	Switch #3 UP
Factory Default Setting	=	DOWN

Switch #3
dB Transmission Levels
(Asynchronous/Synchronous Mode/Leased Line)

DIP-Switch #3 adjusts dB transmission levels required by some phone carriers. Place DIP-Switch #3 in the DOWN position to enable -9 dB transmission. Place DIP-Switch #3 in the UP position to enable -15 dB transmission.

-9dB Transmission	=	Switch #3 DOWN
-15dB Transmission	=	Switch #3 UP
Factory Default Setting	=	DOWN

Switch #4
AS/400 Mode
(Synchronous Mode/Leased Line/Dial-UP)

The modem can function in the IBM AS/400 environment (appearing like an IBM5853 modem). First, DIP-Switch #7 must be placed in the UP position. This establishes an RTS/CTS condition (state typical for an IBM5853 modem in half-duplex mode). Next, place DIP-Switch #4 in the DOWN position. This *"spoofs"* the modem into operating like an IBM5853 modem in AS/400 applications. DIP-Switch #4 in the UP position disables this function. Note that the modem must be in Command mode to allow AS/400 mode (DIP-Switch #8 DOWN); and in Synchronous mode (DIP-Switch #12 UP).

AS/400 Mode Enabled	=	Switch #4 DOWN
AS/400 Mode Disabled	=	Switch #4 UP
Factory Default Setting	=	UP

Switch #4
Unix UUCP Spoofing
(Asynchronous Mode/Leased Line/Dial-Up)

The modem can be configured for use with Unix equipment which employs ACK flow control to monitor data integrity. The modem can do *"UUCP spoofing"*, where the modem is able to generate ACKs at the DTE interface. Data then is transmitted more time-efficiently, because the delay of waiting for data to be received then waiting for the ACK to be returned at the remote end, is eliminated. Placing DIP-Switch #4 in the DOWN position enables UUCP spoofing.

UUCP Spoofing Enabled	=	Switch #4 DOWN
UUCP Spoofing Disabled	=	Switch #4 UP
Factory Default Setting	=	UP

Switch #5
Enable/Disable Auto-Answer - "Ans"
(Asynchronous Mode/Synchronous Mode/Dial-Up)

In some originate-only applications, you may wish to disable the modem's automatic answering capabilities. This may be true if you have a telephone set attached to a modem and wish to receive voice calls that you yourself would answer instead of the modem. Place DIP-Switch #5 in the UP position to enable Auto-Answer. Place DIP-Switch #5 in the DOWN position to disable Auto-Answer.

Auto-Answer Enabled	=	Switch #5 UP
Auto-Answer Disabled	=	Switch #5 DOWN
(Factory Default Setting	=	UP)

Switch #5
Originate/Answer Mode
(Asynchronous/Synchronous Mode/Leased Line)

The modem functions in either Originate mode or Answer mode. Place DIP-Switch #5 in the DOWN position to enable Originate mode. Place DIP-Switch #5 in the UP position to enable Answer mode.

Originate Mode Enabled	=	Switch #5 DOWN
Answer Mode Enabled	=	Switch #5 UP
(Factory Default Setting	=	UP)

Switch #6
Maximum Throughput Setting
(Asynchronous Mode/Leased Line/Dial-Up)

Some applications require you to dial into services with maximum throughput on, and other applications where maximum throughput must be off (i.e., service not supporting error correction, or the V.42 handshake interferes with logon sequence). DIP-Switch #6 is used for switching between these two modes. This DIP-Switch controls three important parameters (error correction, speed conversion and serial port speed), which in effect enables or disables maximum throughput.

Maximum Throughput Enabled	=	Switch #6 UP
Maximum Throughput Disabled	=	Switch #6 DOWN
Factory Default Setting	=	UP

Switch #6
Slave Clocking
(Synchronous Mode/Leased Line/Dial-Up)

In Synchronous mode, DIP-Switch #6 controls the option of having timing controlled by the receive clock. The originate modem, in effect, adjusts to the answer (remote) modem. Place DIP-Switch #6 in the DOWN position to enable Slave Clocking. Place DIP-Switch #6 in the UP position to disable Slave Clocking.

Slave Clocking Enabled	=	Switch #6 DOWN
Slave Clocking Disabled	=	Switch #6 UP
Factory Default Setting	=	UP

Switch #7
Request To Send Forced - "RTS"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

If your computer or terminal uses RTS-CTS protocol (typically used in some synchronous applications, but also if using hardware pacing for V.42 error correction or speed conversion), you may want to set RTS to function independently of CTS (DIP-Switch #7 UP). For most applications, especially asynchronous, this switch should be set so that RTS is forced On (DIP-Switch #7 DOWN)

RTS functions Normally	=	Switch #7 UP
RTS forced On	=	Switch #7 DOWN
Factory Default Setting	=	DOWN

Switch #8
Enable/Disable Command Mode -- "Com"
(Asynchronous/Synchronous Mode/Leased/Dial-Up)

In some applications you may want to disable the modem's Command mode so that the modem does not recognize or react to AT or V.25*bis* commands. This may be true in strictly auto-answer applications where no call origination is required. Place DIP-Switch #8 in the DOWN position to enable Command mode. Place DIP-Switch #8 in the UP position to disable Command mode. The factory default setting is Command mode enabled.

Disable Command Mode	=	Switch #8 UP
Enable Command Mode	=	Switch #8 DOWN
Factory Default Setting	=	DOWN

Switch #9
Digital Loopback Test
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

When in Synchronous mode, this switch controls both Local Digital Loop and Remote Digital Loop tests while on-line. When the Voice/Data switch is toggled to the Answer mode position (UP) and DIP-Switch #9 is in the UP position, the modem performs the Local Digital Loopback test. When DIP-Switch #9 is DOWN and the Voice/Data switch is toggled to Answer mode position (UP), the modem performs the Remote Digital Loopback test.

Local Digital Loopback Test	=	Switch #9 UP
Remote Digital Loopback Test	=	Switch #9 DOWN
Factory Default Setting	=	DOWN

Switch #10
Leased Line/Dial-Up Operation -- "DDD"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The modem operates in either leased-line or dial-up modes. This switch controls leased-line/dial-up operation. Place DIP-Switch #10 in the UP position for Dial-Up operation. Place DIP-Switch #10 in the DOWN position for Leased-Line operation

Dial-Up Operation	=	Switch #10 UP
Leased Line Operation	=	Switch #10 DOWN
Factory Default Setting	=	UP

Switch #11
"AT" Responses/Multi-Tech Responses
(Asynchronous Mode/Leased line/Dial-Up)

In Asynchronous mode, you can set the modem to respond with Result Codes according to the *"Multi-Tech"* command response set (Switch #11 in the DOWN position), or to *"AT"* command response set (Switch #11 in the UP position). The **&Q** command performs the same function (choosing AT or Multi-Tech Result Codes), and is explained further in Section 5.3 of this manual.

"AT" Responses (**&Q1**)	=	Switch #11 UP
"Multi-Tech" Responses (**&Q0**	=	Switch #11 DOWN
Factory Default Setting	=	DOWN

Switch #11
Internal/External Clocking
(Synchronous Mode/Leased Line/Dial-Up)

In Synchronous mode, the transmit clock can be supplied by the DTE on pin 24 of the RS-232C/V.24 interface by placing DIP-Switch #11 UP. Place DIP-Switch #11 in the DOWN position to enable DCE to control clocking (internal clock via pins 15 and 17 of the RS-232/V.24 interface).

External Clock (pin 24)	=	Switch #11 UP
Internal Clock (pins 15/17)	=	Switch #11 DOWN
Factory Default Setting	=	DOWN

Switch #12
Asynchronous/Synchronous Operation -- "Sync"
(Asynchronous/Synchronous Mode/Leased Line/Dial-Up)

The modem can operate in either Asynchronous mode or Synchronous mode. In Synchronous mode, start and stop bits are eliminated. The modem's internal clock circuits on the RS-232C/V.24 pins 15 and 17 are activated. The modem's Command mode is not accessible in Synchronous mode. This switch is a means to alternate and to access either mode. In Synchronous mode, you may want to set the RTS forcing and CTS forcing DIP-Switches so that both of signals act normally (not forced on).

Synchronous Operation	=	Switch #12 UP
Asynchronous Operation	=	Switch #12 DOWN
Factory Default Setting	=	DOWN

Switches #13 and #14
Speed Switches
(Synchronous Mode/Leased Line)

DIP-Switches #13 and #14 are used to set the modem's data transmission rate. Switches #13 and #14 are used in combination, typically in leased-line and call origination applications.

Note: The modem baud rate command (***$MBn***) overrides the setting of these speed selection switches (DIP switches #13 and #14).

28800 bps Operation	=	Switch #13 UP and Switch #14 UP
19200 bps Operation	=	Switch #13 DN and Switch #14 UP
14400 bps Operation	=	Switch #13 UP and Switch #14 DN
9600 bps Operation	=	Switch #13 DN and Switch #14 DN
Factory Default Setting	=	Switch #13 UP and Switch #14 UP

Switch #15
Carrier Detect/DSR Forcing -- "DSR"
(Asynchronous/Synchronous Mode/Dial-Up/Leased Line)

Some terminals react in unusual ways to the toggling of the Carrier Detect (CD - RS-232C/V.24 pin 6) signals. The most common symptom is that the modem does not respond to commands, or does not echo characters. In these cases, it is advisable to force these two signals On in order for the terminal to communicate properly with the modem in Command mode. This is done by setting DIP-Switch #15 DOWN. With DIP-Switch #15 in the UP position, both CD and DSR will be either on or off, depending on the On-Line status.

CD and DSR normal	=	Switch #15 UP
CD and DSR forced On	=	Switch #15 DOWN
Factory Default Setting	=	UP

Switch #16
(Reserved for Future Use)

7.3   Speaker Volume Control

You can adjust the volume of the modem's phone-line monitor speaker with a volume control knob, located on the back of the modem next to the RS-232C connector (see Figure 9-1 for location). Turn the knob clockwise to increase the modem's volume and counterclockwise to decrease speaker volume.

7.4   Recording Option Configurations

This section lets you record any changes you may have made to the DIP-Switch settings. Circle the appropriate setting and record the effect for future reference.

DIP-Switches

Switch	Function	Position	Effect
#1	Force DTR/DTR from Interface*	UP* DOWN	DTR Dependent on Interface DTR Forced On at All Times
#2	Flow Control &E4*/&E5 (Async/Dial-Up/Leased Line)	UP* DOWN	Hardware Flow Control XON /OFF Flow Control
#2	SDLC*/BSC (Sync)	UP* DOWN	SDLC Mode On BSC Mode On
#3	Result Codes Enable*/Disable (Async/Dial-up)	UP DOWN*	Command Mode Response Off Command Mode Response ON
#3	DbM Transmit (-9db/0dB)*/(-15db/-10dB) (Async/Sync/Lease-Line)	UP DOWN*	-15 dB Transmission (leased line) -9 dB Transmission (leased line)
#4	UUCP Enable/Disable* (Async/Dial-Up/Leased Line)	UP* DOWN	UUCP Spoofing Off UUCP Spoofing On
#4	AS/400 Enable/Disable* (Sync/Dial-Up/Leased line)	UP* DOWN	AS/400 Mode Off AS/400 Mode On
#5	Auto-Answer Enable*/Disable (Async/Sync/Dial-Up)	UP* DOWN	Automatic Answer On Automatic Answer Off
#5	Answer*/Originate (Async/Sync/Leased Line)	DOWN UP*	Answer Mode On Originate Mode On
#6	Max-Thru Enable*/Disable (Async/Dial-Up/Leased)	UP* DOWN	Max Throughput On Max Throughput Off
#6	Slave Clock Enable/Disable* (Sync/Dial-Up/Leased)	UP* DOWN	Slave Clocking Off Slave Clocking On
#7	RTS/Normal/Forced* (Sync/Async/Dial/Leased)	UP DOWN*	RTS Dependent on Interface RTS Forced On at All Times
#8	Command Mode Enabled* (Sync/Async/Dial/Leased)	UP DOWN*	Command Mode Off Command Mode On
#9	Local/Remote* LoopBack (Async/Sync/Dial/Leased)	UP DOWN*	Local Digital Loopback On Remote Digital Loopback On
#10	Dial-Up*/Leased-Line	UP* DOWN	Dial-Up Operation Leased-Line Operation
#11	*"AT"/ "Multi-Tech"* Result Codes* (Asynchronous)	UP DOWN*	AT Responses Multi-Tech Responses
#11	Internal Clocking*/External Clocking (Synchronous)	UP DOWN*	External Clocking Selected Internal Clocking Selected
#12	Sync/Async Mode*	UP DOWN*	Synchronous Mode On Asynchronous Mode On

* Factory Default Setting

DIP Switches #13-14

Note: The modem baud rate command (*$MBn*) overrides the setting of these speed selection switches (DIP switches #13 and #14).

SWITCH	CONDITION	EFFECT
#13/#14	UP/UP*	28.8 K bps Operation
#13/#14	DOWN/UP	19.2 K bps Operation
#13/#14	UP/DOWN	14.4 K bps Operation
#13/#14	DOWN/DOWN	9600 bps Operation

DIP Switches #15-16

SWITCH	CONDITION	EFFECT
#15	UP*	CD/DSR from Interface
#15	DOWN	CD/DSR Forced On
#16	UP	Not Used
#16	DOWN*	Not Used

*Standard Factory Default Setting

MultiModem II

Chapter 8 - Warranty, Service and Tech Support

MultiTech Systems

8.1   Introduction

This chapter starts out with statements about your modem's 5-year warranty. The next section, Tech Support, should be read carefully if you have questions or problems with your modem. It includes the technical support telephone numbers, space for recording your modem information, and an explanation of how to send in your modem should you require service. The final four sections explain how to use our Bulletin Board Service (*BBS*), upgrading the modem via Flash PROM, a brief section on the CompuServe/Internet forums and information on Multi-Tech's Fax-Back Service.

8.2   Multi-Tech Systems, Inc. Warranty & Repairs Policies

Warranty

Multi-Tech Systems, Inc., (hereafter "MTS") warrants that its products will be free from defects in material or workmanship for a period of two, five, or ten years (depending on model) from date of purchase, or if proof of purchase is not provided, two, five, or ten years (depending on model) from date of shipment.

MTS MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

This warranty does not apply to any products which have been damaged by lightning storms, water, or power surges or which have been neglected, altered, abused, used for a purpose other than the one for which they were manufactured, repaired by Customer or any party without MTS's written authorization, or used in any manner inconsistent with MTS's instructions.

MTS's entire obligation under this warranty shall be limited (at MTS's option) to repair or replacement of any products which prove to be defective within the warranty period or, at MTS's option, issuance of a refund of the purchase price. Defective products must be returned by Customer to MTS's factory – transportation prepaid.

MTS WILL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES, AND UNDER NO CIRCUMSTANCES WILL ITS LIABILITY EXCEED THE PRICE FOR DEFECTIVE PRODUCTS.

Repair Procedures for U.S. and Canadian Customers

In the event that service is required, products may be shipped, freight prepaid, to our Mounds View, Minnesota factory:

Multi-Tech Systems, Inc.
2205 Woodale Drive
Mounds View, MN 55112
Attn: Repairs, Serial # _____

A Returned Materials Authorization (RMA) is not required. Return shipping charges (surface) will be paid by MTS.

Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check or purchase order for repair charges.

For out of warranty repair charges, go to www.multitech.com/documents/warranties

Extended two-year overnight replacement service agreements are available for selected products. Please call MTS at (888) 288-5470, extension 5308 or visit our web site at http://www.multitech.com/programs/orc/ for details on rates and coverage's.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department at (800) 972-2439 or email tsupport@multitech.com. Please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at (800) 328-9717 or (763) 717-5631, or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Customers (Outside U.S.A. and Canada)

Your original point of purchase Reseller may offer the quickest and most economical repair option for your Multi-Tech product. You may also contact any Multi-Tech sales office for information about the nearest distributor or other repair service for your Multi-Tech product.

http://www.multitech.com/COMPANY/offices/DEFAULT.ASP

In the event that factory service is required, products may be shipped, freight prepaid to our Mounds View, Minnesota factory.   Recommended international shipment methods are via Federal Express, UPS or DHL courier services, or by airmail parcel post; shipments made by any other method will be refused. A Returned Materials Authorization (RMA) is required for products shipped from outside the U.S.A. and Canada. Please contact us for return authorization and shipping instructions on any International shipments to the U.S.A. Please include, inside the shipping box, a description of the problem, a return shipping address (must have street address, not P.O. Box), your telephone number, and if the product is out of warranty, a check drawn on a U.S. bank or your company's purchase order for repair charges. Repaired units shall be shipped freight collect, unless other arrangements are made in advance.

Please direct your questions regarding technical matters, product configuration, verification that the product is defective, etc., to our Technical Support department nearest you or email tsupport@multitech.com. When calling the U.S., please direct your questions regarding repair expediting, receiving, shipping, billing, etc., to our Repair Accounting department at

+(763) 717-5631 in the U.S.A., or email mtsrepair@multitech.com.

Repairs for damages caused by lightning storms, water, power surges, incorrect installation, physical abuse, or user-caused damages are billed on a time-plus-materials basis.

Repair Procedures for International Distributors

Procedures for International Distributors of Multi-Tech products are on the distributor web site.

http://www.multitech.com/PARTNERS/login/

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10-Sep-01

8.3   Online Warranty Registration

If you have access to the World Wide Web, you can register your Multi-Tech product online at *http://www.multitech.com/register/*.

8.4   Replacement Parts

SupplyNet, Inc., can supply you with replacement power supplies, cables and connectors for selected Multi-Tech products. You can place an order with SupplyNet via mail, phone, fax or the Internet at the following addresses:

Mail: SupplyNet, Inc.
          614 Corporate Way
          Valley Cottage, NY 10989
Phone: 800 826-0279
Fax: 914 267-2420
Email: *info@thesupplynet.com*
Internet: *http://www.thesupplynet.com*

8.5   Technical Support

Multi-Tech Systems has an excellent staff of technical support personnel available to help you get the most out of your Multi-Tech product. If you have any questions about the operation of this unit, please call 800 972-2439 (USA and Canada) or 763 785-3500 (international and local). Please have modem information available. You can also contact Technical Support by e-mail at the following addresses:

Country	Email	Telephone
France:	*support@multitech.fr*	+(33) 1-64 61 09 81
India:	*support@multitechindia.com*	+91 (124) 6340778
U.K.:	*support@multitech.co.uk*	+(44) 118 959 7774
U.S.A., Canada	*tsupport@multitech.com*	800 972-2439
Rest of world:	*tsupport@multitech.com*	+763 717-5863

Please note the status of the modem before contacting Technical Support. Status information can include the state of the LED indicators, screen messages, diagnostic test results, problems with a specific application, etc.

8.6   Internet Sites

Multi-Tech is a commercial provider on the Internet. Multi-Tech has a Web site at
http://www.multitech.com
and an ftp site at *ftp://ftp.multitech.com*

MultiModem II

Appendixes

Multi Tech® Systems

Appendix A -- Upgrading Your Modem's Firmware

Your modem is controlled by semi-permanent software, called *firmware*, which is stored in flash memory. Firmware is nonvolatile; that is, it remains stored in memory when the modem is turned off. However, it can be changed by either the manufacturer or the user as bugs are fixed or new features are added.

Since the firmware in your modem is stored in flash memory, you can upgrade it yourself in a few minutes by using the following procedures.

Upgrade Overview

The upgrade procedure consists of the following steps, which are described in greater detail in the following sections.

1. Identify the model number and firmware version of your modem.

2. Identify the current version of the firmware at the Multi-Tech Web site or BBS. If your modem already has the current firmware, there is no need to update it.

3. Download the upgrade file and the appropriate Flash Wizard for your modem.

4. Install the Flash Wizard and extract the firmware .HEX file from the file you downloaded.

5. Document and clear your stored parameters.

6. Upgrade the modem's firmware using the .HEX file and the Flash Wizard.

7. Restore your parameters.

Step 1: Identify the Modem Firmware

You must know the model number and firmware version of your Multi-Tech modem to know whether or not you should update it.

1. Run your favorite terminal program. If you are using Windows 95 or above, you can use Windows HyperTerminal.

2. In the program's terminal window, type **AT&F**. Even if you cannot see the **AT&F** command on your screen, be sure to type it completely, and then press ENTER. If the modem does not respond with *OK*, repeat the **AT&F** command.

3. Now type **ATI**, press ENTER, and record your results. The model number and firmware version should appear .

Step 2: Identify the Current Firmware Version

Identify the current version of the firmware at the Multi-Tech Web site. If your modem already has the current firmware, there is no need to update it.

1. Using your favorite Web browser, go to http://www.multitech.com/SUPPORT/MultiModemZBA/firmware.asp.

2. Scroll down to your modem model number.

3. Look at the firmware version number for your modem.

4. If the firmware version number matches the firmware version number found in "Step 1: Identify the Modem Firmware," you have the current firmware version and do not need to be update.

5. If the firmware version number is greater than the firmware version number found in "Step 1: Identify the Modem Firmware," your modem has an older firmware version. Continue with "Step 3: Download the Upgrade File."

   Warning: The first digit of the new firmware must match the first digit of the old firmware, or the modem may not work properly. E.g., if your current firmware version is 4.16, replace it only with 4.xx firmware, not 6.xx firmware.

Step 3: Download the Upgrade File

1. If you are not already at the MultiModem's Firmware page of the Multi-Tech Web site, follow the procedure in "Step 2: Identify the Current Firmware."

2. Download the upgrade file for your modem by clicking its name, and save the file in a temporary folder on your hard disk.

3. In the same section of the Web page, click the Flash Wizard utility for your operating system to download it, and save it in the same folder.

Step 4: Extract the Upgrade Files

1. Install the Flash Wizard utility by double-clicking the file name in Windows Explorer.

2. Extract the upgrade files by double-clicking the file name. The extracted files include a .HEX file, which contains the upgrade data, and a Readme file.

3. Copy the upgrade .HEX file into the Flash Wizard folder, which, in a default installation, is at C:\Program Files\MultiTech Systems\Flash Wizard\.

Step 5: Clear Your Stored Parameters

Before you flash your modem, you should record the parameters that are currently stored in it, so you can reprogram it after flashing. After you have recorded them, send the **AT&W1Z** command to the modem to clear the stored parameters.

1. Run your favorite terminal program. If you are using Windows 95 or above, you can use Windows HyperTerminal.

2. In the program's terminal window, type **AT&V** and press ENTER to list your modem's current parameters.

3. Record your parameters by saving the screens and sending them to your printer.

4. Type **AT&W1Z** and press ENTER to clear your stored parameters and reset your modem to factory default.

5. Close the terminal program.

Step 6: Upgrade the Modem's Firmware

Before you begin the following procedure, read the README.TXT file extracted from the upgrade archive file. Note the file name for the new firmware (example: ARQG125A.HEX).

WARNING: Never install an older version of firmware over a newer version. Doing this WILL DESTROY THE FLASH PROM! If the flash PROM is destroyed, the modem must be sent in for repair.

1. Run Flash Wizard by double-clicking its icon or file name, or by selecting it from the Start menu. The **Identifying Devices** dialog box is displayed as Flash Wizard locates and identifies the devices connected to your system.

   Note: If the message *ERROR: No valid devices detected* is displayed, verify that the modem is turned on and that all cables are correctly and securely attached.

2. Click the modem to be upgraded, and then click **Next** to proceed.

3. Select the port to be upgraded from the **Port** list, select the appropriate .HEX file from the **Hex File** list, and then click **Next** to continue.

   Note: Do not use FLASHLDR.HEX. This file is used internally by Flash Wizard.

4. The **Progress** dialog box appears, showing a status bar that indicates the progress of the upgrade.

   Caution: Any disruption of the program during this stage of the upgrade can cause your modem to become inoperable. Wait for the **Next** button to become active before proceeding.

5. When the flash upgrade is complete, the message *Programming Complete* appears. Click **Next** to continue.

6. The **Results** dialog box appears next. Click **Finish** to exit Flash Wizard.

Step 7: Restore Your Parameters

Your modem has been updated. You can now open your terminal program to reprogram your modem parameters or to confirm the update by typing **ATI** in the terminal window and pressing ENTER.

Appendix B - Troubleshooting

Your modem was thoroughly tested at the factory before it was shipped. If you are unable to make a successful connection or if you experience data loss or garbled characters during your connection, it is possible that the modem is defective. However, it is more likely that the source of your problem lies elsewhere. Problems you may encounter include the following:

- None of the LEDs light when the modem is on.
- The modem does not respond to commands.
- The modem dials but is unable to make a connection.
- The modem disconnects while on-line.
- The modem cannot connect when answering.
- File transfer is slower than it should be.
- I am losing data.
- I am getting garbage characters on the monitor.
- I can't run my fax and communications software at the same time.

If you experience problems, please check the following possibilities before calling Tech Support.

None of the LEDs Light When the Modem Is On

When you turn on the modem, the LED indicators on the front panel should flash briefly as the modem runs a self-test. If the LEDs remain off, the modem is probably not receiving power.

- Make sure the modem's power switch is on, especially if you normally turn on the modem by turning on a power strip.
- If the power supply is plugged into a power strip, make sure the power strip is plugged in and its power switch is on.
- Make sure the power supply module is firmly connected to the modem and to the wall outlet or power strip.
- If the power strip is on and the modem switch is on, try moving the modem power supply to another outlet on the power strip.
- Test that the outlet is live by plugging a lamp into it.
- The modem or power supply may be defective. If you have another Multi-Tech modem, try swapping modems. If the problem goes away, the first modem or power supply may be defective. Call Tech Support for assistance.

CAUTION: Do not under any circumstances replace the power supply module with one designed for another product, as it may damage the modem and void your warranty.

The Modem Does Not Respond to Commands

- Make sure the modem is plugged in and turned on. (See "None of the LEDs Light When the Modem Is On.")
- Make sure you are issuing the modem commands from the data communications software, either manually in terminal mode or automatically by configuring the software. (You cannot send commands to the modem from the DOS prompt.)
- Make sure you are in terminal mode in your data communications program, then type **AT** and press ENTER. If you get an *OK* response, your connections are good and the problem likely is in your phone book entry or session settings.
- Try resetting your modem by turning it off and on. Make sure there is a reset command (**&F**) in your initialization string, or your modem may not initialize correctly.

- If you don't get an *OK*, the problem may still be in the communications software. Make sure you have done whatever is necessary in your software to make a port connection. Not all communications programs connect to the COM port automatically. Some connect when the software loads and remain connected until the program terminates. Others can disconnect without exiting the program (make sure the Connect icon looks plugged in). If the terminal reports that it cannot make a connection, yet the modem's TR indicator is on, click on the Window menu to see if more than one terminal is open. The modem's TR indicator shows that the software has made a connection with the modem through the COM port.

- Your communications software settings may not match the physical port the modem is connected to. The serial cable may be plugged into the wrong connector—check your computer documentation to make sure. Or you may have selected a COM port in your software other than the one the modem is physically connected to—compare the settings in your software to the physical connection.

- If the modem is on, the cable is plugged into the correct port, the communications software is configured correctly, and you still don't get an *OK*, the fault may be in the serial cable. Make sure it is firmly connected at both ends.

- Is this the first time you have used the cable? If so, it may not be correct. Check the cable description on the packaging to make sure the cable is the right one for your computer.

- Peripheral expansion cards, such as bus mouse and sound cards, may include a serial port pre-configured as COM1 or COM2. The extra serial port, or the card itself, may use the same COM port, memory address, or interrupt request (IRQ) as your communications port. Be sure to disable any unused ports.

  To look for address or IRQ conflicts if you use Windows 3.1x, select File, Run in Program Manager, type **MSD**, and press ENTER. Then select Mouse, COM Ports, and IRQ Status and note the addresses and IRQs that are in use. If you find an IRQ conflict, note which IRQs are not being used, then change one of the conflicting devices to use one of the unused IRQs. If you find an address conflict, change the address of one of the conflicting devices.

  To change a port address or IRQ in Windows 3.1x, double-click the Control Panel icon, then the Ports icon. Click on the port you want to change, click Settings, click Advanced, and select the new port address and/or interrupt. If you wish to use COM3 or COM4, note that COM3 shares an IRQ with COM1, as does COM4 with COM2, so you should change their IRQs to unused ones, if possible.

  If you use Windows 95, right-click on My Computer, select Properties from the menu, click on the Device Manager tab, double-click on Ports, then double-click on the Communications Port your modem is connected to. In the port's Properties sheet, click on the Resources tab to see the port's Input/Output range and Interrupt Request. If another device is using the same address range or IRQ, it will appear in the Conflicting Device List. Uncheck Use Automatic Settings to change the port's settings so they do not conflict with the other device, or select the port the conflicting device is on and change it instead. If you need to open your computer to change switches or jumpers on the conflicting device; refer to the device's documentation.

- The serial port may be defective. If you have another serial port, install the modem on it, change the COM port setting in your software, and try again.

- The modem may be defective. If you have another Multi-Tech modem, try swapping modems. If the problem goes away, the first modem is possibly defective. Call Tech Support for assistance.

The Modem Dials But Cannot Make a Connection

There can be several reasons the modem fails to make a connection. Possibilities include

- lack of a physical connection to the telephone line.
- a wrong dial tone.
- a busy signal.
- a wrong number.
- no modem at the other end.
- a faulty modem, computer, or software at the other end.
- incompatibility between modems.

You can narrow the list of possibilities by using extended result codes. To enable them, enter **ATV1X4** and press ENTER while in terminal mode, or include **V1X4** in the modem's initialization string. When you dial again, the modem will report the call's progress.

- If the modem reports NO DIALTONE, check that the modem's telephone line cable is connected to both the modem's LINE jack (not the PHONE jack) and the telephone wall jack. If the cable looks secure, try replacing it. If that doesn't work, the problem may be in your building's telephone installation. To test the building installation, plug a telephone into your modem's telephone wall jack and listen for a dial tone. If you hear a dial tone, your modem may be installed behind a company phone system (PBX) with an internal dial tone that sounds different from the normal dial tone. In that case, the modem may not recognize the dial tone and may treat it as an error. Check your PBX manual to see if you can change the internal dial tone; if you can't, change your modem's initialization string to replace **X4** with **X3**, which will cause the modem to ignore dial tones.

- If the modem reports BUSY, the other number may be busy, in which case you should try again later, or it may indicate that you have failed to add a **9,** prefix to the phone number if you must dial *9* for an outside line.

  If you must dial *9* to get an outside line, the easiest way to dial it automatically is to include it in the modem's dial prefix, e.g., **ATDT9,**. Note the comma, which inserts a pause before the number is dialed. By inserting **9,** into the dial prefix, you do not have to include it in each directory entry in the terminal.

  To change the dial prefix in Windows Terminal, select Settings, Modem Commands. To change it in Windows 95 HyperTerminal, select Call, Connect from the menu bar, click Dialing Properties, and type **9** in the local and long distance boxes in How I Dial from This Location.

- If the modem reports *NO ANSWER*, the other system has failed to go off-hook, or you might have dialed a wrong number. Check the number.

- If the modem reports *NO CARRIER*, the phone was answered at the other end, but no connection was made. You might have dialed a wrong number, and a person answered instead of a computer, or you might have dialed the correct number but the other computer or software was turned off or faulty. Check the number and try again, or try calling another system to make sure your modem is working. Also, try calling the number on your telephone. If you hear harsh sounds, then another modem is answering the call, and the modems may be having problems negotiating because of modem incompatibilities or line noise. Try connecting at a lower speed.

The Modem Disconnects While On-line

• If you have call waiting on the same phone line as your modem, it may interrupt your connection when someone tries to call you. If you have call waiting, disable it before each call. In most telephone areas, you can disable call waiting by preceding the telephone number with ***70** (check with your local telephone company).

You can automatically disable call waiting by including the disabling code in the modem's dial prefix (e.g., **ATDT*70,**—note the comma, which inserts a pause before the number is dialed). To change the dial prefix in Windows Terminal, select Settings, Modem Commands. To change it in Windows 95 HyperTerminal, select Call, Connect from the menu bar, click Dialing Properties, check this location has Call Waiting, and select the correct code for your phone service.

• If you have extension phones on the same line as your modem, you or someone else can interrupt the connection by picking up another phone. If this is a frequent problem, disconnect the extension phones before using the modem, or install another phone line especially for the modem.

• Check for loose connections between the modem and the computer, the telephone jack, and AC power.

The Modem Cannot Connect When Answering

• Auto-answer may be disabled. Turn on auto-answer in your datacomm program or send the command **ATS0=1** to your modem in terminal mode.

File Transfer Is Slower Than It Should Be

• You may have an older UART. For best throughput, install a 16550AFN UART or a Multi-Tech ISI serial port card. See the "Quick Start" chapter for information on how to identify your UART.

• If you are running under Windows 3.1 and have a 16550AFN UART, you must replace the Windows serial driver, COMM.DRV, to take full advantage of the UART's speed.

• If you are using a slow transfer protocol, such as Xmodem or Kermit, try Zmodem or Ymodem/G instead.

• Is your line noisy? If there is static on your line, the modem has to re-send many blocks of data to insure accuracy. You must have a clean line for maximum speed.

• Are you downloading a compressed file with MNP 5 hardware compression enabled? Since hardware data compression cannot compress a file already compressed by an archiving program, the transfer can be marginally slower with data compression enabled than with it disabled.

• Try entering the **L8** (List Online Diagnostics) command in on-line mode, making a screen print of the diagnostics listing, and checking for parameters that may be unacceptable (number of retrains, round trip delay, etc.).

I Am Losing Data

• If you are using data compression and a high speed serial port, set the serial port baud rate to four times the data rate.

• Make sure the flow control method you selected in software matches the method selected in the modem. If you have a Macintosh, you may have the wrong cable for hardware flow control.

• Try entering the **L8** (List Online Diagnostics) command in on-line mode, making a screen print of the diagnostics listing, and checking for parameters that may be unacceptable (number of retrains, round trip delay, etc.).

I Am Getting Garbage Characters on the Monitor

- Your computer and the remote computer may be set to different word lengths, stop bits, or parities. If you have connected at 8-N-1, try changing to 7-E-1, or vice-versa, using your communications software.

- You may be experiencing line noise. Enable error correction, if it is disabled, or hang up and call again; you may get a better connection.

- At speeds above 2400 bps, the remote modem might not use the same transmission or error correction standards as your modem. Try connecting at a slower speed or disabling error correction. (With no error correction, however, line noise can cause garbage characters.)

- Try entering the **L8** (List Online Diagnostics) command in on-line mode, making a screen print of the diagnostics listing, and checking for parameters that may be unacceptable (number of retrains, round trip delay, etc.).

My Fax and Communications Software Won't Run at the Same Time

Communications devices can be accessed by only one application at a time. Under DOS or Windows 3.1x, you can run either your fax software or your datacomm software, but not both at the same time, unless you have a special communications device management application, such as Multi-Tech's Virtual Modem Driver. In Windows 95, you can have data and fax communication applications open at the same time, but they cannot use the same modem at the same time.

Apendix C - AT Command Summary

Command	Values		Description
AT			Attention Code that precedes most command strings except A/, A: and Escape Codes.
RETURN			Pressing RETURN key executes most commands.
$			This symbol placed in dialing string enables the modem to detect AT&T's "call card" tones for accessing user's calling card to originate an on-line connection.
A			Answer call, even if no ring present. Repeat last command. (Do not precede this command with AT. Do not hit RETURN to execute.)
A:			Continuous redial (10 redials in DOC units) of last number until answered. (Not used Internationally.)
$An	n = 0 or 1	*	$A0 discards data during auto-reliable time period. $A1 buffers data during auto-reliable time period.
#An	n = 0 thru 3	*	#A0 selects initial handshake at:33,600 to 31,200 to 28,800 to 24000 to 21,600 to 19,200 to 16,800 to 14,400 to 12,000 to 9600 to 4800 to 2400 to 1200 to 300 bps. #A1 selects initial handshake at 33,600 bps only. #A2 selects initial handshake at 33,600 to 31,200 to 28,800 to 24000 to 21600 to 19,200 to 16,800 19,200 to 14,400 to 9600 to 4800 bps. #A3 selects initial handshake at 2400 to 1200 to 300 bps.
			* Factory Default Setting
Bn	n = 0 or 1	*	B0 selects V.21 answer tone. B1 selects Bell answer tone.
&Bn	n = 0 or 1	*	&B0 means normal transmit buffer size. &B1 means reduced transmit buffer size.
&BSn	n = 0 or 1	 *	&BS0 means maximum transmit block size of 64 characters. &BS1 means maximum transmit block size of 256 characters.
$BAn	n = 0 or 1	*	$BA0 means speed conversion is on. $BA1 means speed conversion is off.
&Cn	n = 0,1,2,4	 *	&C0 forces Carrier Detect on. &C1 lets Carrier Detect act normally. &C2 lets Carrier Detect drop S24 time on disconnect. &C4 resets modem when Carrier Detect drops.
&CDn	n = 0 or 1	*	&CD0 execute cleardown on disconnect. &CD1 do not execute cleardown on disconnect.
Ds	s = phone #		Dial a telephone number "s," where s may include up to 60 digits or T, P, R, comma and ; characters.

Command	Values	Description
Ds**N**d	s = phone #	Store telephone number. To store, phone d = 0 thru 9 number "s" is entered and followed by N and then Directory Number "d."
&Dn	n = 0 thru 3	&D0 DTR is ignored &D1 means modem returns to command mode. * &D2 lets modem react to DTR normally. &D3 causes modem to reset to modem default parameters.
%DFn	n = 0 or 1	* %DF0 Line Probe Data in Graph Format. %DF1 Line Probe Data in Table Format.
%DPn	n = 0 or 1	* %DP0 do not read Line Probe Information from DSP during handshaking. %DP1 read Line Probe Information from DSP during handshaking.
$Dn	n = 0 or 1	* $D0 disables DTR Dialing. $D1 enables DTR Dialing.
En	n = 0 or 1	E0 means do not echo Command Mode Character. * E1 means do echo Command Mode characters.
&En	n = 0 thru 15	&E0 means no error correction. * &E1 means V.42 Auto-reliable Mode. &E2 means V.42 Reliable Mode. &E3 means no modem-initiated flow control. * &E4 means CTS modem-initiated flow control. &E5 means Xon/Xoff modem-initiated flow control. * &E6 means Xon/Xoff not passed through. &E7 means Xon/Xoff passed through. * &E8 means Enq/Ack pacing off. &E9 means Enq/Ack pacing on. * &E10 means Normal Mode flow control off. &E11 means Normal Mode flow control on. &E12 means Pacing off. * &E13 means Pacing on. &E14 means data compression disabled. * &E15 means data compression enabled.
$EBn	n = 0 or 1	* $EB0 enables 10 bit mode. $EB1 enables 11 bit mode.
%En	n=0 thru 5	% E0 = Modem Won't Escape. * % E1 = +++ Method (default setting). % E2 = Break Method. % E3 = Either +++ or Break Method. % E4 = No "OK" Response to +++ % E5 = "OK" Response to +++
#Fn	n = 0 thru 2	#F0 means no fallback when on-line. #F1 means fallbackwhen on-line (increments of 2400 bps). * #F2 means fallback to 4800 bps/fall forward if line improves (increments of 2400 bps).

***&F*n**	n = 0, 8 or 9		&F loads factory default values from ROM.
		*	&F8 reads factory default values and switch settings when &F is issued.
			&F9 reads parameters stored in non-volatile memory when &F is issued.
***$F*n**	n = 0 or 1		$F0 means do not fall back to normal connect if CR received.
		*	$F1 means fall back to normal connect if CR received.
***&G*n**	n = 0, 1 or 2	*	&G0 turns off CCITT guard tones.
			&G1 turns on CCITT 550 Hz guard tone.
			&G2 turns on CCITT 1800 Hz guard tone.
***H*n**	n = 0 or 1		H0 means Hang Up (go on hook).
			H1 means Go Off Hook.
***$H*n**	n = 1 thru 3		$H1 brings up Help Screen #1.
			$H2 brings up Help Screen #2.
			$H3 brings up Help Screen #3.
***I*n**	n = 0,1or 2		I0 requests modem ID #.
			I1 requests firmware revision #.
			I2 for MTS internal use.
I9	Read Only		Command enables display of Windows 95 Autodetect characteristics
L			Lists all stored telephone numbers in memory.
L5			L5 lists all current operating parameters.
L6			L6 lists all current S-Register values.
L7			L7 lists additional parameters.
L8			L8 lists On-Line Diagnostics.
L9			L9 Displays Signal Strength Information.
L10			L10 Displays Signal to Noise Ratio Information.
L11 (			L11 Displays Noise Information.
***#L*n**	n = 0 thru 3	*	#L0 means modems negotiate V.42 Mode.
			#L1 means MNP on and LAP-M off.
			#L2 means LAP-M on and MNP off.
			#L3 means no detection phase but go directly to LAP-M.
***M*n**	n = 0 thru 3		M0 means Monitor speaker always Off.
		*	M1 means Monitor speaker On until carrier detected
			M2 means Monitor speaker always On.
			M3 Monitor speaker on during dialing/off during handshaking.

***$MB*n**	n = speed		$MB75 selects CCITT V.23 mode. $MB300 selects 300 bps on-line. $MB1200 selects 1200 bps on-line. $MB2400 selects 2400 bps on-line. $MB4800 selects 4800 bps on-line. $MB9600 selects 9600 bps on-line. $MB14400 selects 14400 bps on-line $MB19200 selects 19200 bps on-line $MB28800 selects 28800 bps on-line
		*	$MB33600 selects 33600 bps on-line
***&M*n**	n = 0 or 1	*	&M0 selects Async when on-line. &M1 selects Sync when on-line.
***N*d**	d = 0 thru 9		Dial stored telephone number "d" (Do not include the letter D in this command.)
***N*d*N*e**	d = 0 thru 9 e = any other number 0 thru 9		Number Linking. If first number dialed is busy, another stored number may be automatically dialed. In example, stored number d is dialed, and if busy, stored number e is dialed.
O			Exit Command Mode and go into On-Line Mode.
P		*	Modem will pulse-dial numbers following the P.
***&P*n**	n = 0 or 1	*	&P0 means 60-40 pulse ratio. &P1 means 67-33 pulse ratio.
***Q*n**	n = 0, 1 or 2	*	Q0 means Result Codes sent. Q1 means Result Codes will be suppressed (quiet). Q2 means Dumb Answer Mode.
***&Q*n**	n = 0 or 1	*	&Q0 selects Multi-Tech command set. &Q1 selects AT command set.
***R*n**	n = 0 or 1	*	R0 means modem will not reverse modes. R1 means modem will reverse modes.
***&R*n**	n = 0, 1 or 2	 *	&R0 lets Clear to Send act normally. &R1 forces Clear to Send on. &R2 drops for 1 second on disconnect.
&RP			Command Initiates a Retrain that makes the processor read Line Probe Information (valid only in V.34 mode).
***$R*n**	n = 0 or 1	*	$R0 means disconnect after 12 retransmits. $R1 means do not disconnect after 12 retransmits.
***&RF*n**	n = 0 or 1	 *	&RF0 selects CTS follows RTS. &RF1 selects CTS to act independently
***S*r=n**	r = 0-11, 13, 15-19, 24-26, 29, 30, 32, 34...		Sets value of Register "r" to value of "n", where "n" is entered in Decimal format.
***S*r?**	r = 0-11, 13, 15-19, 24-26, 30, 32 or 34...		Reads value of Register "r" and displays value in 3-digit Decimal format.

$SBn	n = speed		$SB300 selects 300 bps at serial port.
			$SB1200 selects 1200 bps at serial port.
			$SB2400 selects 2400 bps at serial port.
			$SB4800 selects 4800 bps at serial port.
			$SB9600 selects 9600 bps at serial port.
			$SB19200 selects 19,200 bps at serial port.
			$SB38400 selects 38,400 bps at serial port.
		*	$SB57600 selects 57600 bps at serial port.
			$SB115200 selects 115200 bps at serial port.
&SFn	n = 0 or 1	*	&SF0 selects DSR follows CD.
			&SF1 selects DSR independent.
&Sn	n = 0, 1 or 2		&S0 forces Data Set Ready On.
		*	&S1 lets Data Set Ready act normally.
			&S2 Data Set Ready drop is regulated by S24 on disconnect.
$SPn	n = 0 or 1	*	$SP0 disables UUCP Spoofing
			$SP1 enables UUCP Spoofing
T			Modem will tone-dial numbers following the T.
&Tn	n = 4 or 5		&T4 means Enable Response to Request for Remote Digital Loopback.
		*	&T5 means Disable Response to Request for Remote Digital Loopback.
#Tn	n = 0 or 1		#T0 turns off Trellis Coded Modulation
		*	#T1 turns on Trellis Coded Modulation
Un	n = 0, 1, 2, or 3		U0 places modem in Analog Loop Originate Mode.
			U1 places modem in Analog Loop Answer Mode.
			U2 places modem in Remote Digital Loopback test mode.
			U3 places modem in Local Digital Loopback test mode.
$VDn	n= 0 or 1	*	$VD0 disables Voice/Data Dialing
			$VD1 enables Voice/Data Dialing
Vn	n = 0 or 1		V0 means Result Codes sent as digits (terse response).
		*	V1 means Result Codes sent as words (verbose response).
W			Wait for new dial-tone.
&Wn	n = 0 or 1		&W0 causes modem to store its current parameters in non-volatile RAM, and modem will load these for future sessions instead of reading factory ROM defaults, unless &F command used.
		*	&W1 causes modem to not store parameters.

*X*n	n = 0,1,2,3 or 4	*	X0 selects Basic Result Codes (w/o CONNECT 1200, CONNECT 2400). X1 selects Extended Result Codes (w/CONNECT 1200, CONNECT 2400). X2 selects Standard AT Command set with NO DIAL TONE. X3 selects Standard AT Command set with BUSY. X4 selects Standard AT Command set with NO DIAL TONE and BUSY.
#Xn	n= 0 or 1	*	#X0 selects single XOFF character sent until XON level returns. #X1 selects multiple XOFF characters after buffer level is full.
*Y*n	n = 0 or 1	*	Y0 disables sending or responding to long space "break". Y1 enables sending or responding to long space "breaks".
Z			All configuration parameters are reset to default values.
,	In Dial Command		Causes pause during dialing.
;	In Dial Command		Causes return to Command Mode after dialing.
!	In Dial Command		Causes modem to flash On-Hook.
@	In Dial Command		Causes modem to wait for ringback, then 5 seconds of silence before processing next part of command.
+++AT<CR>			In-band Escape Sequence. Places modem in Command Mode while still remaining On-Line. Enter +++ followed by the letters A and T, up to ten command characters, and a RETURN.
BREAK AT<CR>			Out-of-band Escape Sequence. Places modem in Command mode while still remaining On- Line. Enter a BREAK signal, followed by the letters *A* and *T,* up to sixty command characters, and hit RETURN.

* Factory Default Setting

Callback Security/Remote Configuration Command Summary

Command	Description
#DBn	**#DB0** disables Callback Security and answering Yes to the prompt turns off Callback Security and erases stored phone numbers and passwords. Answering No to the prompt aborts the command. **#DB1** activates remote and local password security. **#DB2** activates remote password security.
#CBNyyxxxxxx	Callback password with xxxxxx being callback password and yy being the memory location. Callback password xxxxxx must start with a non-numeric character and upper/lower case sensitive. Callback password xxxxxx must be a minimum of 6 and maximum of 10 characters. yy memory locations are from 0 to 29. Must specify P (pulse) or T (tone) dialing in string.
+ - Dxxxxxx???Nxx	Callback Phone Numbers xxxxxx with the + preceding the phone number indicating the callback modem phone number for the corresponding password at the same memory location. The (-) preceding the phone number enables direct entry when the caller uses the correct password without the callback modem having to return the call. The ??? entry at the end of the phone number represents an extension added to the main phone number. The Nxx is the memory location of the callback phone number and password.
#Pn	Parity of the prompt messages sent by the callback modem. **#P0** is no parity **#P1** is odd parity **#P2** is even parity
#RCBNxx	Erases the callback password stored at memory location xx. Memory locations are 0 to 29.
#RDNxx	Erases the callback phone number stored at memory location xx. Memory locations are 0 to 29.

Password Command Summary

Command	Description
#Ixxxxxxxxxx	Login Password is any keyboard characters (x) (upper/lower case sensitive), minimum 6 and maximum 10 characters. The default Login Password is **#IMULTI-TECH**.
#Syyyyyyyyyy	Setup Password is any keyboard characters (y) (upper/lower case sensitive), minimum 6 and maximum 10 characters. The default Setup Password is **#SMODEMSETUP**.

V.25bis Commands

<ins>Command</ins>	<ins>Description</ins>
$Vn	**$V0** returns modem to AT command mode when in V.25bis mode.
	$V1 enables V.25bis mode of operation.
	$V2 allows modem to receive one V.25bis command while in AT command mode without leaving AT command mode.
	$V5 DSR follows DTR in V.25bis mode.
	$V6 DSR does not follow DTR in V.25bis mode.
CSPs	Changes the serial bps rate.
	CSP0300 - 300 bps **CSP1200** - 1200 bps **CSP2400** - 2400 bps **CSP4800** - 4800 bps **CSP9600** - 9600 bps **CSP19200** - 19200 bps **CSP38400** - 38400 bps **CSP57600** - 57600 bps (2834 **CSP115200** - 115200 bps
CRNdd	Dials phone number dd where dd can be up to 20 characters (0 through 9, *, #, P, T and :). Phone number is checked against the Delayed and Forbidden Number lists before dialed.
CRIdd;nn	Dials dd same as CRN Command and ignores nn identification string. The disregard or connect to incoming calls commands are used for auto-answer operations.
DIC or CIC	**DIC** stops the modem from answering incoming calls.
	CIC causes the modem to answer incoming calls.

Appendix D - V.25bis Operation

Chapter 4 described a set of commands which let the modem dial, hang-up, and be configured for various applications. However, these commands, the AT command set, are only functional when the DTE transmits data asynchronously. That is, they cannot be used with synchronous equipment such as that found in IBM's Binary Synchronous Communications (*BSC*) and Synchronous Data Link Control (*SDLC*)* environments.

The ITU V.25*bis* commands provide you with an alternate set of commands and responses to those described in Chapter 5 for applications in which the DTE is synchronous. V.25*bis* commands support dialing functions in asynchronous or synchronous mode according to the recommendations of the ITU; however, the AT commands are understood to reign in the asynchronous world, while the V.25bis commands are relegated to the synchronous world of datacomm. If you need to establish a datacomm link over Public Switched Telephone Network (*PSTN*) dial-up services, and your equipment outputs a synchronous data stream, V.25*bis* commands are essential. V.25*bis* mode AT commands do not include any modem configuration commands. You can execute normal AT commands in V.25*bis* mode for modem configuration.

Delayed and Forbidden Numbers

V.25*bis* provides the facility to delay failed call retry attempts by putting numbers that failed to connect on a special Delayed Number list. Subsequent dialing of these numbers will be delayed (time specified by a country regulation) and an appropriate message displayed. If the number is retried more than the maximum allowed number of times (number is also specified by country regulation), it is placed on the Forbidden Numbers list, and no further retries will be allowed. When the Forbidden Numbers list is full, no dialing is allowed and a CFIFF indication is given. The modem in AT command mode will respond with *NO CARRIER*. If country regulations require that the Forbidden Numbers list be checked in AT mode, then *NO CARRIER* will be the response to a dial attempt in AT mode. Numbers will also be put on the Forbidden Numbers list if the Delayed Numbers list is full and a new number fails for the first time. In that case, the new number will be added to the Delayed Number list and the oldest existing number added to the Forbidden Numbers list. Numbers are removed from the Forbidden Numbers list by after a certain time has past (also by country regulation).

Some country regulations have numbers remain on the Forbidden Numbers list permanently. The Delayed Number and Forbidden Numbers lists are eight numbers long (20 characters each).

V.25bis Operation

Operation in V.25*bis* mode is similar to AT command mode in that certain DIP-Switch functions are important to its operation. V.25*bis* does not include any speed detection for asynchronous mode, so when you are giving commands, you must stay in your initial speed (i.e., if you change your terminal speed while entering an AT command, you will get no responses). In synchronous mode, the modem supplies the clock, so the synchronous terminal *"knows"* the speed.

You must be in V.25*bis* mode for the commands described here to function. Most AT commands will also function, except those associated with dialing such as *ATD*, *ATN*, *ATO*, and *ATU*. To get into V.25*bis* mode, you type **AT$V1**. At this point your modem does no more speed or parity detection (things associated with asynchronous operation). To get out of V.25*bis* mode and back into AT command mode, enter **AT$VO**. The **AT$V2** command allows you to run one V.25*bis* command from AT command mode without
leaving AT command mode.

There is no command to select between asynchronous and synchronous V.25*bis* operation. The position of DIP-Switch #12 selects between modes. For synchronous mode, DIP-Switch #12 must be UP, and the AT command mode enabled.

Another asynchronous mode concern is the problem of connecting at a different speed than the speed at which the serial port is set. If your modem port speed is different from the serial port speed, you must either:

    1)   Enable speed conversion and have flow control on, or

    2)   Enable connect responses (with the *ATX1* command) and change the serial baud rate after receiving a connect message.

If the *$VD1* command is entered when in Auto-Answer mode, the modem answers immediately upon receiving the first ring.

There is no disconnect message (*NO CARRIER*) if a normal connection is made.

V.25bis Set-Up and Initialization

Before you operate your modem in the V.25*bis* mode, you need to make sure it is set up properly (various RS-232 lines such as DSR and CTS act as specified in the V.25*bis* standard). Setup involves proper DIP-Switch settings and soft-switches (software controlled conditions).

V.25bis DIP-Switches

#1	Unforced DTR
#2	NA
#3	NA
#4	NA
#5	Auto-Answer enabled
#6	Async - Max throughput set
	Sync - Slave Clocking unforced
#8	Command Mode forced
#9	Digital Loopback Off
#10	Dial-Up
#11	Async - AT/Multi-Tech Resp.
#12	Async/Sync mode set per requirements

V.25bis Mode AT Commands

The following commands will either alter standard V.25*bis* behavior (so you must be careful in their use) or they are not allowed, as indicated. All other commands can be used in V.25*bis* operation.

A	Not Allowed
A/	Not Allowed
A:	Not Allowed
D	Not Allowed
D...N	Not Allowed
$D	Alters Operation ($D1 in V25*bis* is direct call mode)
E	Alters Operation
&F	Alters Operation (removes modem from asynchronous V.42*bis* mode)
N	Not Allowed
N...N	Not Allowed
O	Not Allowed
P	Not Allowed
T	Not Allowed
U	Not Allowed
W	Not Allowed
X	Alters Operation (X0 no connect message, X1 connect message)
,	Not Allowed
;	Not Allowed
!	Not Allowed
@	Not Allowed
+++AT<CR>	Not Allowed

V.25bis Responses (Result Codes)

When in V.25*bis* mode (the **AT$V1** command executed), your modem provides you with several responses which can help you follow the progress of V.25*bis* operations. These are similar to the Result Codes associated with AT Command mode operation. The V.25*bis* responses are in the form of three-character mnemonics as listed below:

INC	Incoming Call (same as RING indicator)
VAL	A valid V.25*bis* command has been attempted
DLC*t*	Call delayed for *t* minutes (number on Delayed list)
CFI*rr*	Call failure indicator where *rr* equals:
	et - Engaged tone (same as BUSY)
	nt - Call Answered but No Answer Tone
	ab - Call Not Answered
	fc - Number on Forbidden List
	ns - Number not stored in memory
	ua - User Abort
	nd - No Dialtone
	ff - Forbidden List full
LSN*mm;dd...dd*	Phone number in V.25*bis* memory
LSD*mm;dd...dd*	Phone number on the Delay list
LSF*mm;dd...dd*	Phone number on the forbidden list
CON *ssss*	Connection at ssss speed (if X1 in effect)

V.25bis AT Commands

The AT commands associated with V.25*bis* mode are described as follows. Note that one command enables and disables V.25*bis* mode and the rest are only operable in the V.25*bis* mode.

Enable/Disable V.25bis Mode ($V) Command

The function of the **$V** command is to select the V.25*bis* mode in asynchronous mode. (Synchronous mode is set up with switches. For example, the modem could be in AT command mode, (**AT$V1**), and if synchronous mode is enabled with AT Command mode enabled, then V.25*bis* mode is selected). Prior to executing this command, make sure that your modem is properly set up to perform the type of operation you will be performing. Refer to the initialization section of this appendix for information about modem set-up. When in V.25*bis* mode, most normal AT commands will also function (except **D,N,O** and **U**). V.25*bis* operates in asynchronous or synchronous modes (depending on the position of DIP-Switch #12), and does not check for terminal speed (so do not change speeds while in this mode) or parity. In synchronous mode, speed is not important since the internal clocks provide synchronization.

To place your modem in V.25*bis* mode from asynchronous mode, enter the **AT$V1** command. To return to AT command mode, enter the **AT$V0** command. **AT$V2** allows you to run one V.25*bis* command from AT command mode without leaving AT command mode (the V.25*bis* command follows **$V2** on the command line).

Change Serial Baud Rate (CSP) Command

The **CSP** command will change the serial baud rate of your modem by entering **CSP*ssss*** where ***ssss*** can equal:

0300	=	300 bps
1200	=	1200 bps
2400	=	2400 bps
4800	=	4800 bps
9600	=	9600 bps
19200	=	19200 bps
38400	=	38400 bps
57600	=	57600 bps
115200 =		115200 bps

Dial Phone Number Provided (CRN) Command

The CRN command permits the dialing of the phone number immediately following it (from the command line). It is similar to the **D** command of the AT command set, except that the number is first checked against the Delayed Number and Forbidden Number list. If permitted, depending on the country regulations in effect, the number will then be dialed. For example, if you enter **CRN7859875** and hit RETURN, your modem will check the two lists. If the number is on the Delayed Numbers list, you can dial that number again after t minutes have passed. If the number is on the Forbidden list, a **CFIFC** message will be displayed.

You can use various commands from the AT command set within the CRN command line to facilitate the dialing process, such as **P**, **T**, or **:** for pulse dialing, tone dialing and wait for dial tone. V.25*bis* supports *"smart"* dialing.

To dial a phone number, enter **CRNdd...dd** where **dd...dd** is the phone number, which can be up to 20 characters long using any character on the telephone pad (0 through 9, *, #, P, T, and :).

Some additional dialing characters may be available, based on country regulations.

Listing Delayed Phone Numbers (RLD) Command

When a phone number is dialed by a CRN command and a connection is not made, the number is entered in the modem's V.25*bis* Delayed Number list along with the number of retry attempts. Any further dialing attempts will be delayed some amount of time (determined by the regulations of each country). While the delay is in progress, the modem will give a DLC indication. The list contains eight numbers. When filled, the next number failing *"bumps"* off the oldest number on the list onto the Forbidden Number list. Numbers on the Delayed Number list that succeed in a connect attempt are removed. If a certain number of failed attempts occur (the number of failed attempts is specified by each country), the number is entered into the V.25*bis* Forbidden Phone Number List. Forbidden phone numbers cannot be dialed at all. To list the phone numbers on the V.25*bis* Delayed Phone Number List, enter **RLD** and hit RETURN.

Listing Forbidden Phone Number (RLF) Command

Those phone numbers that have failed to connect the required number of times as specified by country regulations are removed from the Delayed Number list and entered onto the V.25*bis* Forbidden Number list. Numbers on the Forbidden Number list cannot be dialed at all for some maximum amount of time, which is also specified by country regulations. In some countries, the time might be one hour, and in others the number may never be dialed again. The forbidden list is eight numbers long, with the newest number replacing the oldest if the memory is full. To list the numbers in the Forbidden list enter **RLF** and hit RETURN.

Disregard or Connect to Incoming Calls (DIC or CIC) Command
The Disregard or Connect to Incoming Calls commands are used for Auto-Answer operations. Depending on the country regulations, your modem will wait some amount of time or number of rings before answering the call. During that time, you can stop the modem from answering the call by entering the **DIC** (Disregard Incoming Calls) command. **CIC** (Connect to Incoming Calls) command will cause your modem to answer the call (either reversing the effect of a DIC command or simply have your modem answer the call immediately without waiting the regulation time before answering).

DTR Dialing ($D) Command

DTR Dialing is an alternate method of causing the modem to automatically dial a number. Data Terminal Ready (DTR) is a signal that comes into the modem from the terminal or computer to which it is connected via pin 20 of the RS-232 interface. In DTR Dialing, the modem will automatically dial a stored number as soon as it receives a high DTR signal. The DTR Dialing method is popular when using the modem in synchronous applications.

To enable DTR Dialing, enter command **AT$D1** and hit Return. The modem will now dial the phone number you have stored as N0 when it receives a high DTR signal.
DTR must remain high for the duration of the call, until disconnect. To disable DTR Dialing, enter the command **AT$D0** (or **AT$D**) and hit RETURN.

When you use DTR Dialing, be sure that DIP-Switch #1 is in the UP position, so that DTR is not forced on. In addition, when using DTR Dialing in a synchronous application, be sure that DIP-Switch **#8** is in the UP position to disable V.25*bis* Command mode.

ITU V.25bis Country Specific Information

Due to the flexibility of the V.25*bis* standard, each country may establish specific regulations governing the way operations are handled. The purpose of this document is to detail each country's specific regulations that affect operation of V.25*bis* in Multi-Tech modems.

1. <u>**Italy**</u>
- a)   Command/Indication modifications
  - 1.   Phone number indications include status ;ZPSTTT
    - a)   Z - U, D, or F, for Unrestricted, Delayed or Forbidden
    - b)   P - Delay time if delayed
    - c)   S - Number of retries so far
    - d)   TTT - Interdiction time to further attempts
- b)   Delayed and Forbidden list behavior
  - 1.   5 retries without delay
  - 2.   2 minute delay between next 4 retries
  - 3.   After 9 retries the number is put on the forbidden list
  - 4.   120 minute timer is started on entry to delay list
  - 5.   When it runs out, the number is removed from which ever list it is on
- c)   Auto-Answer mode behavior
  - 1.   Auto-Answer in 5 seconds if no DIC
  - 2.   Get 10 seconds after DIC to enter CIC
  - 3.   If 10 seconds times out then no connection is possible

2. <u>**Switzerland**</u>
- a)   Command/Indication modification
  - 1.   Modem must remain on-hook for 5 seconds after disconnect
  - 2.   Modem must remain on-hook for 5 minutes after 4 consecutive failed calls
  - 3.   If modem must remain on-hook, then it is "paused"
  - 4.   If the modem is paused and a call is attempted a **PAU** indication is given.
    - a) **PAUt** Modem is paused for **t** minutes
- b)   Delayed and Forbidden list behavior
  - 1.   2 minute delay between 4 retries
  - 2.   After 4 retries the number is put on the forbidden list
  - 3.   The number remains on the forbidden list forever
- c)   Auto-Answer behavior
  - 1.   Auto-Answer mode after 2 rings if no **DIC**

3.   **Austria**

   a)   Command/Indication modification (none)
   b)   Delayed and Forbidden list behavior
      1.   No delay between retries
      2.   After 2 retries to numbers that answer, but give no answer tone (***CFINT***), the number is put on the forbidden list
      3.   After 10 retries with busy or no dialtone, the number is put on the forbidden list
      4.   The number remains on the forbidden list forever
      5.   Delayed and Forbidden Numbers lists are checked when dialing in AT mode. If dialing is not possible then *NO CARRIER* is the response.
   c)   Auto-Answer behavior
      1.   Auto-Answer in 5 seconds if no DIC

4. **France**

   a)   Command/Indication modification (none)
   b)   Delay and Forbidden list behavior
      1.   2 min. delay after 1st call, 4 after 2nd, 6 after 3rd, etc.
      2.   After 5 retries, the number is put on the forbidden list
      3.   The number remains on the forbidden list forever
      4.   Delayed and Forbidden Numbers lists are checked when dialing in AT command mode. If dialing is not possible then No Carrier is the response.
   c)   Auto-Answer mode behavior
      1.   Auto-Answer in 5 seconds if no ***DIC***

 5. **Belgium**

   a)   Command/Indication modification (none)
   b)   Delay and Forbidden list behavior
      1.   1 min. delay between calls
      2.   After 4 retries, the number is put on the forbidden list
      3.   The number remains on the forbidden list for 1 hour after entry to forbidden list
      4.   Delayed and Forbidden Numbers lists are checked when dialing in AT command mode. If dialing is not possible then No Carrier is the response.
   c)   Auto-Answer behavior
      1.   Auto-Answer in 5 seconds if no ***DIC***.

6. **Singapore**

   a)   Command/indication modifications
      1.   Dialing digit '=' means wait for dialtone (acts the same as ':' in dialing string).
   b)   Delay and Forbidden list behavior
      1.   5 retries without delay
      2.   2 minute delay between next 4 retries
      3.   After 9 retries the number is put on the forbidden list
      4.   120 minute timer is started on entry to delay list
      5.   When it runs out, the number is removed from whichever list it is on.

Appendix E - MultiModemBA Cables

These cables connect your modem to your terminal or computer's serial port.

25-PIN **DTE** Connector		25-PIN **DCE** Device
TD 2	————————	2 TD
RD 3	————————	3 RD
RTS 4	————————	4 RTS
CTS 5	————————	5 CTS
DSR 6	————————	6 DSR
GND 7	————————	7 GND
CD 8	————————	8 CD
DTR 20	————————	20 DTR
RI 22	————————	22 RI
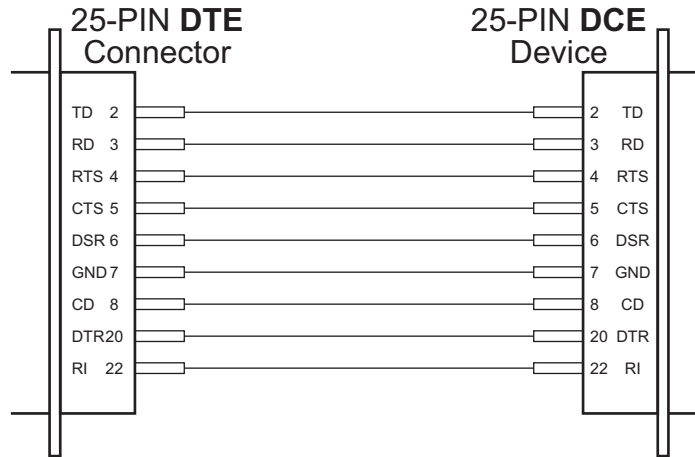
Figure E-1. RS232 Cable (IBM PC)

RJ-11 Type
Modular Plug

1
2
3 ———— RED (Tip) ————
4 ———— GREEN (Ring) ————
5
6

To Terminal
Block Screws
(Transmit and Receive)
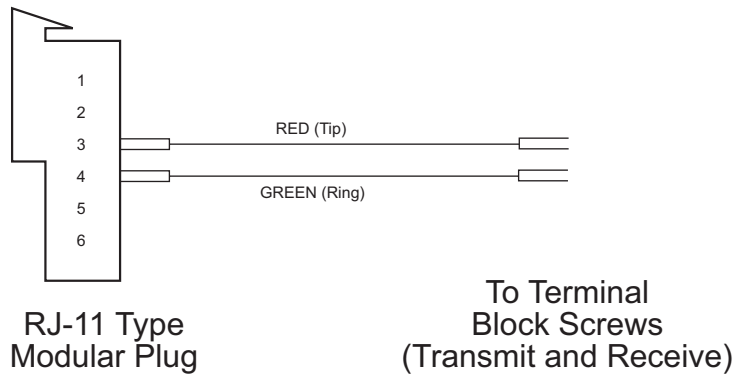
Figure E-2. Two Wire Leased Line Connection

Appendix F - Regulatory Information

FCC Part 15

This equipment has been tested and found to comply with the limits for a **Class B** digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC rules. Operation of this device is subject to the following conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Reglement Canadien sur le matériel brouilleur.

FCC Part 68 Telecom

1. This equipment complies with part 68 of the Federal Communications Commission Rules. On the outside surface of this equipment is a label that contains, among other information, the FCC registration number. This information must be provided to the telephone company.

2. The suitable USOC jack (Universal Service Order Code connecting arrangement) for this equipment is shown below. If applicable, the facility interface codes (FIC) and service order codes (SOC) are shown.

3. An FCC-compliant telephone cord and modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises wiring using a compatible modular jack that is Part 68 compliant. See installation instructions for details.

4. The ringer equivalence number (REN) is used to determine the number of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the device not ringing in response to an incoming call. In most, but not all, areas the sum of the RENs should not exceed 5.0. To be certain of the nuber of devices that may be connected to the line, as determined by the total RENs, contact the local telephone company.

5. If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify you as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

6.   The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.

7.   If trouble is experienced with this equipment (the model of which is indicated below) please contact Multi-Tech Systems, Inc. at the address shown below for details of how to have repairs made. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.

8.   No repairs are to be made by you. Repairs are to be made only by Multi-Tech Systems or its licensees. Unauthorized repairs void registration and warranty.

9.   This equipment should not be used on party lines or coin lines.

10. If so required, this equipment is hearing-aid compatible.

11. **Manufacturer:**   Multi-Tech Systems, Inc.
    Trade Name: MultiModem
    Model Number: MultiModemBA
    FCC Registration No: AU7USA-65363-MD-E
    Ringer Equivalence No: 0.5B
    Modular Jack (USOC): RJ-11C or RJ-11W (single line)
    Service Center in USA: Multi-Tech Systems, Inc.
                                  2205 Woodale Drive
                                  Mounds View, MN 55112
                                  U.S.A.
                                  (763) 785-3500
                                  (763) 785-9874
                                  U.S. Fax 763-785-9874

Canadian Limitations Notice

Notice: The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

Notice: The Industry Canada label identifies certificated equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Industry Canada label does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations. Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment or equipment malfunctions may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

International Modem Restrictions

Some dialing and answering defaults and restrictions may vary for international modems. Changing settings may cause a modem to become non-compliant with national telecom requirements in specific countries. Also note that some software packages may have features or lack restrictions that may cause the modem to become non-compliant.

EMC, Safety, and R&TTE Directive Compliance

The CE mark is affixed to this product to confirm compliance with the following European Community Directives:

•   Council Directive 89/336/EEC of 3 May 1989 on the approximation of the laws of Member States relating to electromagnetic compatibility;

    and

•   Council Directive 73/23/EEC of 19 February 1973 on the harmonization of the laws of Member States relating to electrical equipment designed for use within certain voltage limits;

    and

•   Council Directive 1999/5/EC of 9 March on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.

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